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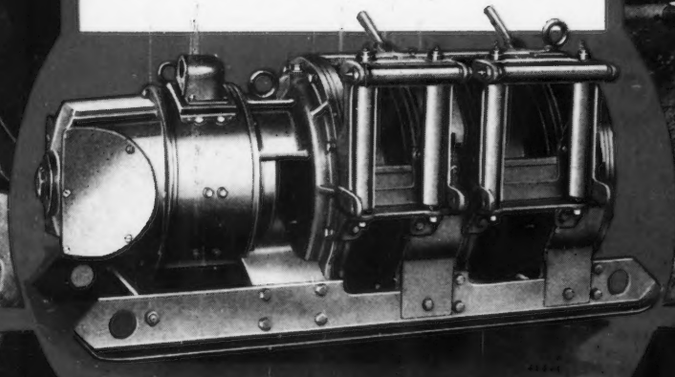

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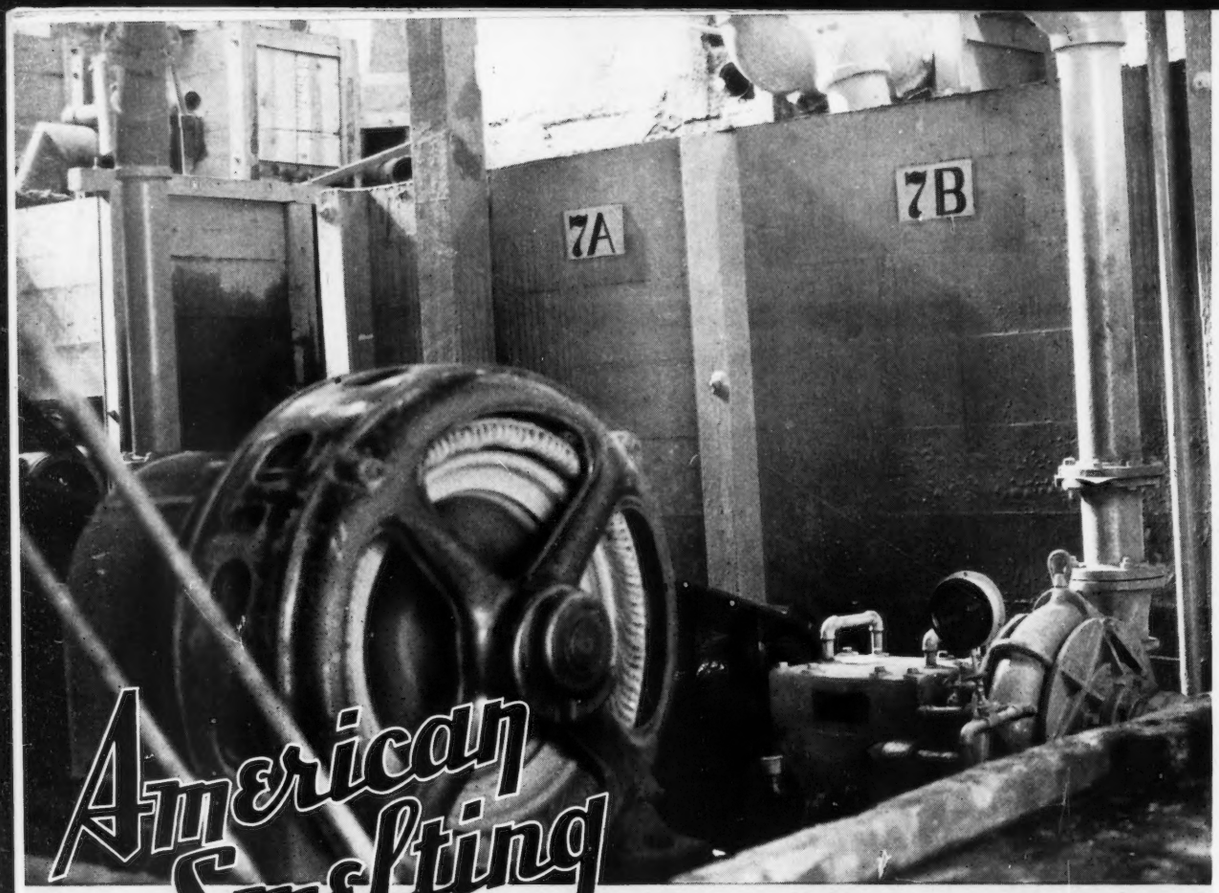

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Nature Note. A recent landslide near Buhl, Idaho, has been the signal for release of numerous explanations of the phenomenon by amateur scientists. Ralph V. Thurston, Payette, Idaho, reports several ingenious theories advanced by local wiseacres, among them the collapse of a large volcanic bubble or volcanic tube. Another person explained that, prior to the lava flow which covered southern Idaho, there was a deep canyon at this spot which filled with molten lava. But somehow the lava drained back, leaving a vast cavity, which is now collapsing. "But the prize," says Mr. Thurston, "goes to the lady who made a priceless contribution to economic geology by telling us just how gold gets into quartz." According to Mrs. Tibbs' letter to the *Idaho Daily Statesman*, "The bottom of this quartzite (or old sandstone) is formed by pressure and time into a coarse grey quartz filled with holes. Gold dust fills these holes." Simple, isn't it?

▼

3 x 3 x 3 = 13½ in Missouri. Browsing in a late copy of the *Federal Reporter*, Charles Labbe, of Goldfield, Nev., discovered the following comment in the syllabus of Hill vs. Ring Constr. Co., 19 Fed. 434: "The national common law under which a cubic yard is 27 cu.ft. governs contract between federal post office building contractor and subcontractor for earth excavation of post office site over which state surrendered its jurisdiction so as to bar subcontractor a recovery of stipulated amount per cubic yard of earth excavated on basis of 13½ cubic feet per cubic yard under state statute. The law of the state surrendering its jurisdiction over post office site purchased by United States continued to be binding the contractor, unless inconsistent with national laws. Missouri St. Ann. No. 11072, 11073, p. 4857." Mr. Labbe wonders if the same relationship holds with a Missouri ton.

H. C. PARMELEE
Editorial Director

Engineering and Mining Journal

A. W. FISHER
Manager

Published by McGraw-Hill Publishing Co., Inc.
WILLARD CHEVALIER
Vice-President

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Oldest Gold Mines. Following recent surveys made of the Skukkary mines, located on the Red Sea littoral near Kosseir and known to be the oldest gold-bearing areas in the world, the Egyptian Government has reopened the mines on a large scale, according to a report to the Department of Commerce by James T. Scott, American Commercial Attaché, Cairo. A modern mining and milling plant has been purchased and it is reported that the gold extracted during the first ten days of August following commencement of operations on Aug. 1 was valued at approximately $20,000.

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First Cyanide Test on Rand banket in 1890 has been disclosed in the course of research into the history of the Consolidated Gold Fields of South Africa, Ltd. Mr. John Jack, founder of the original Simmer & Jack Mining Company, produced a certificate of a test on ore taken by him from the Primrose mine in 1889 and submitted to J. S. McArthur in Glasgow. Mr. Jack witnessed the test, which resulted in an extraction of only 63 per cent by amalgamation and 97 per cent by cyanidation. The success of the test marked the turn of prosperity of mining on the Rand.

Published monthly. Subscription rates. United States and Canada, $3 per annum; other countries in the Americas outside the United States and Canada, $4 per annum; elsewhere $5 or 20 shillings per annum. Price per copy 50c or 2s. Application for entry as second-class matter at Albany, N. Y., pending. Printed in U. S. A.

McGRAW-HILL PUBLISHING COMPANY, INC.
Publication Office, 99-129 North Broadway, Albany, N. Y.
Editorial and Business Offices, 330 W. 42d St., New York, N. Y.
Cable Address: McGraw-Hill, N. Y.
San Francisco: 883 Mission Street
Chicago: 520 North Michigan Avenue
Washington, D. C.: National Press Building

McGRAW-HILL PUBLISHING COMPANY, LTD.
Aldwych House, Aldwych,
London, W.C.2, England
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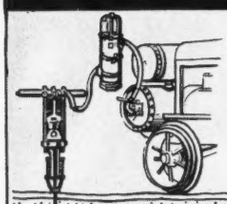

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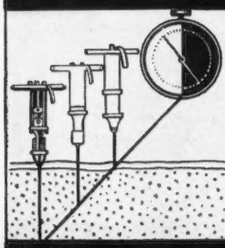

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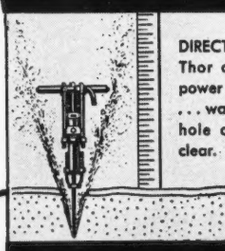

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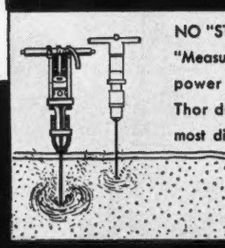

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Volume 138 Number 10

OCTOBER 1937

Supply Overtakes Demand

PRODUCERS of major non-ferrous metals have suffered a severe shock in the general collapse of prices that occurred at the very time when all industry was comfortably set for a revival in business for the fall season. As September closed, prices for both copper and lead were back to January levels, with zinc and tin well under the highs for the year and somewhat heavy.

Copper, the bellwether of the non-ferrous group, sold down to 12¢ a pound in the domestic market, Connecticut Valley basis, late in September. This compares with the high of 17¢ that prevailed for a brief period early in the year when President Roosevelt broke the market by issuing his warning on rising prices. After the spring boom passed into history, the domestic price of copper settled at 14¢ and continued at that figure for almost five months. Consumers voiced little opposition to the 14¢ basis. Many in the industry regarded the price as a fair one, but it could not be maintained under the pressure of a falling rate of activity and greatly stimulated world production. The fear of a shortage in raw materials has disappeared, temporarily at least, and this change in the mood of the buyers has undoubtedly exerted a powerful influence on the general price structure.

Not long ago the American Bureau of Metal Statistics issued figures on domestic consumption of copper for the first half of 1937. These figures showed an increase in the use of copper by important consuming industries of slightly more than 31 per cent, an astonishing gain. We incline to the view that the high rate of activity in the first half of the year was excessive, and the business world is now passing through a necessary readjustment that should prove beneficial in the end. Signs are not lacking that the important producers of metal will readjust their production schedules in time to bring about a more stabilized condition in prices, which is needed to restore buying confidence.

Activity in the Iron Country

HAPPIER DAYS have been experienced this year in the Lake Superior Iron Country, which, in the depths of the depression, tasted varied bitterness. Activity proceeds at a pace promising that total lake shipments for the current season will almost equal those of the banner years of 1916 and 1929—66,672,359 and 66,157,359 tons, respectively.

Long an incubator and developer of new ideas in mining practice, the Iron Country in its open-pit mines is now experimenting extensively with conveyors, trucks, scrapers, and combinations of them for moving ore in those operations where the time-honored means of railroad switchbacks out of the pits has become expensive or requires that valuable ore now needed be left in the benches beneath the tracks. Time will yield the data necessary for judging the value of these methods.

Research in iron ore beneficiation proceeds apace, as yearly larger and larger tonnages of the open-pit ores are being improved in grade. Prominent among the more interesting practices under test, if not in commercial use, is the jigging of unsized material, which promises well.

In the Iron Country's underground mines operators have been forehanded in meeting the challenge of dust disease. By studied expenditure for effective ventilation, by water sprays placed in drifts at critical points, and by wetting down headings and other workings, as well as by the use of respirators, working conditions are being produced underground, in which, it would seem, a miner can scarcely acquire dust disease. Improved methods of counting dust particles in air samples have also been devised, thus placing the entire program on a surer footing.

Burdensome taxation on iron ore continues to

afflict most of the mines of Minnesota, from which State comes the bulk of the Iron Country's shipments. The situation is made worse by the fact that much of the money thus collected is spent with slight regard for the future of the producing districts. The burden, moreover, has retarded the progress of research and the quest for new ore.

Open Season for Tall Stories

TIN IN MICHIGAN, nickel in Virginia, radium in a California desert, and a landslip in Idaho relieved the summer languor of the editor's office with a series of fantastic tales. The cause is obscure. Perhaps human hope rises with the temperature and stimulates the imagination to new flights of fancy. And then, of course, sun spots must not be overlooked. In some mysterious way they affect everything, from fecundity in wild animals to the frequency of great natural disasters. In any event we record, for what it is worth, the scientific observation that tall stories in the mining industry tend to concentrate in hot weather.

Up in Michigan a persistent geologist found tin occurring "over an area of at least 700 square miles." The mineral is "a true alpha stannic oxide." He sent us a specimen, which seemed to be a nice piece of schist. Ignoring the simple field test accompanying the rock, we resorted to the spectrograph in the hands of a competent operator. Result: no trace of tin, but generous quantities of silicon, aluminum, and iron. Incidentally, the efficient spectrograph revealed the presence of traces of several important metals. But tin—alpha, or for that matter beta and gamma—was conspicuously absent.

The radium story captured the daily press, largely because a woman owns the mining claims. She stoutly maintained the discovery of ore which a San Diego chemist is reported to have analyzed and found rich in radium. Being right down *Life's* alley, that picture magazine devoted two pages to the "Radium Queen" and her romantic discovery, incidentally embellishing the tale with the statement that, in addition to radium, the "property also contains helium." (This *must* be the effect of sun spots.) For ourselves, careful inquiry of competent authorities leads to the conviction that the story is like many another mirage of the desert.

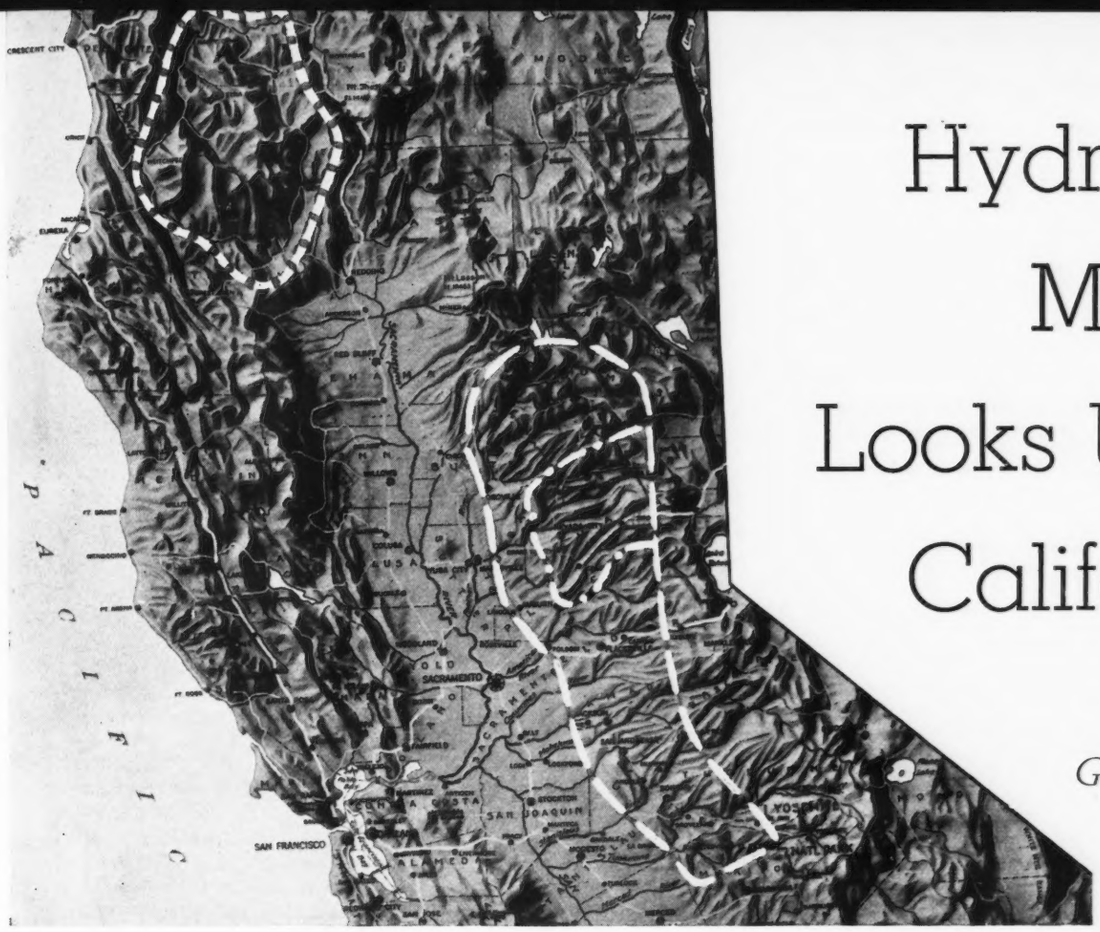
Reserving comment on 7 per cent nickel ore in Virginia until the story grows taller, we turn to the Idaho landslip. Again *Life,* with good pictures, of course, repeated the popular explanation—an ancient lava flow, a surface crust beneath which the lava drained away, leaving a huge subterranean cavern the roof of which is now collapsing. In contrast to the large number of people that will read this misinformation, few will see the press release of the United States Geological Survey on the subject. Based on reports from its field office in Idaho, the U.S.G.S. states that the landslip was caused by the Salmon Falls River undercutting the silty beds of the Snake River plains, allowing large masses of earth to break away. But this is far too logical and commonplace to suit imaginative folk. Meantime winter is coming on, and tall stories will probably subside with the temperature.

Mr. Mellon and Research

COMMENTATORS on the remarkable industrial and financial career of Andrew W. Mellon generally overlooked a minor incident of major consequence. We refer to his chance acquaintance with Robert Kennedy Duncan, which led ultimately to the establishment of the Mellon Institute of Industrial Research at Pittsburgh. Mr. Mellon himself told the story at the dedication of the Institute's magnificent building last May. It is a simple story of a man with an idea which appealed to another man who did something about it.

Thirty years ago Professor Duncan, teaching chemistry in the University of Kansas, wrote a fascinating book, "The Chemistry of Commerce." In it he advanced the thought that science applied to industrial problems held the key to future progress in the United States. And to test his idea he set up a system of industrial fellowships to study manufacturers' problems. About this time Mr. Mellon, concerned with the solution of some of his own problems, was referred to Duncan's book. He read it and straightway decided to get acquainted with the author. As a result of that acquaintance Dr. Duncan was invited in 1910 to come to the University of Pittsburgh as professor of industrial chemistry and director of industrial research. Fellowships were established and proved so successful that in 1913 the Mellon brothers founded the Institute.

Nearly 4,000 American companies have put their problems up to the Mellon Institute, resulting in the development of new products, processes, and even new industries. On March 1, 1937, 64 fellowships were in operation, requiring the services of 177 scientists and engineers. Appropriations by the donors for the year preceding that date amounted to more than $800,000. Such was the growth of an idea in a quarter century. Mr. Mellon believed in research, endowed it handsomely, and made the finest facilities available to American industry at moderate cost.



Hydraulic Mining Looks Up in California

As projected Government-built debris dams approach realization

THE FUTURE of hydraulic mining in California depends on the areas inclosed within the broken lines. That in the Sierra Nevada is outlined in long dashes. Within this area, outlined with a dot-dash line, is the portion that will be served by the projected dams. In the northwestern corner is the Klamath-Trinity area outlined with a line of shorter dashes.

Leroy A. Palmer
Consulting Engineer
333 Montgomery St.,
San Francisco, Calif.

HYDRAULIC MINING in California is definitely on the upgrade. With the general interest in gold mining that came as an incident to the depression, capital turned again to hydraulicking as a means of producing gold. Interest was stimulated by the advance in the price of gold; in fact to the extent that the oft-discussed project of Government-constructed dams for the impounding of débris was revived and finally brought to the point that they will soon become a reality.

In considering hydraulic mining in California one must bear in mind that there are two districts of importance. The deposits of the Sierra Nevada are better known, as they are larger and have been made the subject of many romantic tales, but those tributary to the Klamath River drainage in Trinity and Siskiyou counties are important in their own right and would be better known were they not in the same State with their neighbors which are for the most part much larger.

The Sierra Nevada—When, on Jan. 23, 1884, the United States Circuit Court of Appeals handed down the "Sawyer decision" in the case of Evans Woodruff vs. North Bloomfield Gravel Mining Company *et. al.*, it practically wiped out the hydraulic mining industry in the Sierra Nevada of California. At that time the industry represented an investment approximating $100,000,000, investments in individual mines ran as high as $3,000,000, 6,000 miles of ditches and vast storage reservoirs had been constructed, production was $10,000,000 to $12,000,000 a year, and these mines were credited with having added over $200,000,000 to the gold reserves of the nation.

The one saving point in the Sawyer decision was that it did not enjoin hydraulic mining as such: it enjoined the mines from dumping their tailings in such a manner that they would be carried to a navigable stream and particularly specified that they might operate if they provided some means of adequately restraining their débris.

Drastic as the decision was, we must admit its justice. A survey by Government agencies in 1880 [1] showed that on the Feather, Yuba, and Bear rivers 39,000 acres of agricultural land were destroyed and 14,000 injured, the damage exceeding $3,250,000. The river channels were clogged and navigation was affected as far as San Francisco Bay. To prevent even further damage to the land, extensive levies had to be built and enlarged year by year.

Many surveys of the gravel deposits have been made, one estimate carefully prepared showing 4,000,000,000 cu.yd. of an average value of 15c. (Gold $20.67). Other estimates have differed considerably from the one just mentioned, and the subject is one in which there can be wide latitude. Obviously, $600,000,000 worth of gravel did not lie idle all of these years without inciting efforts to recover some of it.

Many attempts were made by individual mines to impound their tailings, but as a whole these were not successful. Grades of the smaller canyons are steep, so that a dam of reasonable height afforded only limited storage. On the larger streams good sites are available which would serve several mines, but a dam at one of these would be expensive. The Sawyer decision was the culmination of ten years of expensive and exhausting litigation, and following it practically all of the mines shut down either because the owners were enjoined or knew they would be. The industry was worn out and disorganized and the necessary cooperation and

financing for the master dams were not forthcoming.

Out of approximately 500 mines formerly operating only one has maintained operation each year to date. Fred Joubert is still working the Depot Hill mine, in Sierra County, established by his grandfather and great uncle, and never failing to produce at least some gold, even in seasons of low water, every year since 1855.

The first decisive step looking toward rehabilitating the industry was the passage of the Caminetti act in 1893. This created the California Débris Commission, composed of three engineer officers of the United States Army, and entrusted it with the supervision and regulation of hydraulic mining. Much was expected of the act, as it authorized the Commission to build débris dams when the proper appropriations were made, but in this it was a disappointment. The joker was that it provided that the Government should be reimbursed for the cost of the dams by a tax of 3 per cent on the output of the mines. This would mean 0.45c. per cubic yard on the average gravel, and even the most optimistic did not expect to get storage for that figure.

At various times the Débris Commission made surveys and estimates of the possibilities of storage, but for the most part its duties, so far as the hydraulic mines were concerned, consisted of supervising the sporadic efforts to resume operation.

In 1925 the State Legislature created the Hydraulic Mining Commission, with instructions to investigate the possibilities of a resumption of hydraulic mining. The Commission employed Arthur Jarman as engineer, and in due time submitted a well-considered report[2] showing the feasibility of building débris dams at certain strategic points and storing behind them at a reasonable cost. Although eight rivers carried débris from the Sierra Nevada to the Great Valley, about two-thirds of this came from the Yuba, Bear, and American, so Jarman's investigations, as well as those subsequent, were confined to those three streams. The attempt to enlist aid by the State died when the 1927 Legislature refused further appropriation.

At about this time the California Débris Commission, under the chairmanship of Colonel T. H. Jackson, investigated, and on April 20, 1928, reported adversely. Again after some years of inaction the subject was revived, and on Aug. 18, 1933, by a House resolution, the Débris Commission was requested to review its former report and make recommendation. In doing this the Commission made a re-survey of the entire territory, and while this was in progress Congressman Harry Englebright, of California, put through Congress an amendment to the Caminetti act. The "Englebright amendment," as it is popularly referred to, provides that the cost of débris dams shall be returned to the Government by a tax per cubic yard of gravel mined based on the capacity and cost of the individual dams. This remedied the weak point in the original act.

On Feb. 13, 1935, the Débris Commission submitted the "Jackson report,"[3] a careful review of the situation, with estimates of yardage available, presumed values, designs and estimated costs of four dams on the Yuba, Bear, and Middle and North Forks of the American, and a twenty-year operating program. The report closed with an adverse recommendation that seemed to many to be inconsistent with the facts brought out in the body of the document. The principal grounds for the adverse recommendation were that there was no adequate information based on "suitable sampling methods" as to the value of the gravels and that the problem was a local one that should not be undertaken by the Government.

Table I.—Volume and Value of Hydraulickable Gravel on Middle and South Forks of Yuba and Bear Rivers and North and Middle Forks of American River

Stream	Yardage	Value Cents	Gross Value
Yuba			
Middle Fork	320,000,000	16.9	$54,100,000
South Fork	68,000,000	19.5	13,300,000
Bear	53,000,000	26.6	14,100,000
American			
North Fork	87,000,000	19.5	17,000,000
Middle Fork	76,000,000	17.1	13,000,000
Totals	604,000,000	18.5	111,500,000

The hydraulic operators asked for a hearing on the report, at which they contended that the value of the deposits was demonstrated by detailed records of extensive operations over a period of years and that this was better proof than conventional sampling methods. Furthermore, they declared that the recommendation that storage should not be undertaken by the Government was directly contrary to the Caminetti act, under which the Débris Commission functions, which specifically authorizes the construction of dams such as contemplated.

The Board of Engineers concurred in the views of the protestants, and on May 23, 1935, recommended to the Committee on Rivers and Harbors[4] that the four dams be built at a cost of $6,945,000 but that construction should not start until assurances had been filed by responsible individuals or corporations that they would move sufficient yardage in twenty years to repay the cost of the dams. Congress approved the project at the 1935 session but did not make an appropriation.

Meantime, what constituted "assurances to the satisfaction of the Secretary of War" was rather indefinite, and the Débris Commission itself was somewhat in the dark on the subject. Among the first "assurances" filed were many that made the most extravagant claims as to yardage to be moved, but without any evidence as to the responsibility of the applicant or his ability to carry out his plans. Finally, a form was agreed upon in which the applicant submits a statement of his land holdings, yardage and value of gravel, water rights, construction program, operating program, inventory, corporate set-up, financial statement, and a declaration that he is financially able to equip and operate the property. These regulations were such as to restrict the applications to responsible parties, and in due time the quota for each dam was subscribed. At the request of the War Department the 1936 Congress appropriated $100,000 for final exploration at two of the dam sites, and this work is now in progress.

Before considering the dams to be built mention should be made of one that has been operated successfully by private interests for some time. The Bullard's Bar dam of the Pacific Gas & Electric Company, on the North Fork of the Yuba, was completed in January, 1924. It has a height of 175 ft., with a storage capacity of 31,600 acre-feet (50,000,000 cu.yd.). The Débris Commission has licensed the use of 40,000,000 cu.yd. of this space for débris storage. As power generation is an important feature of the project, the storage rate is low, 2c. per cubic yard of bank washed, with an allowance for boulders left in the pit.

A number of estimates have been made of the volume of gravel amenable to hydraulicking on the streams on which it is proposed to build dams. The Jarman and Jackson reports, giving due consideration to all conditions now existing, are in closest accord as to total yardage; namely, 685 and 604 millions respectively, although the estimates for individual streams vary materially. Both figures are in excess of that for which storage can be provided.

The Débris Commission did not attempt to fix a value for the gravels; in fact, it contended that it could not be done; but Jarman made a careful estimate based on the best available data. Table I shows the value and the yardage of the gravel on the different streams, using the Commission's estimate of yardage and Jarman's estimate of value computed to $35 per ounce.

The yardage is in excess of the

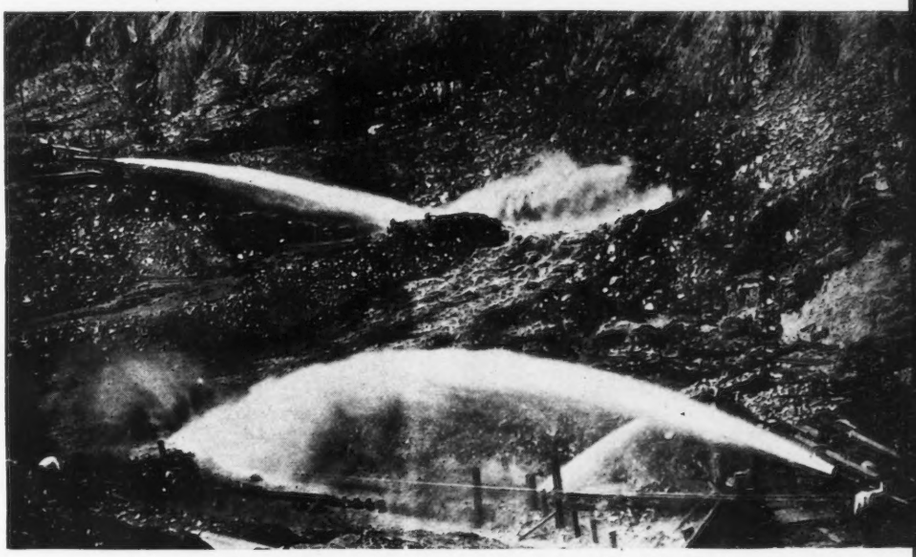
capacity of the most practical sites for storage, but the Débris Commission has designed dams that will afford storage over a twenty-year period at a price per cubic yard that will amortize the cost and allow the mines to work at a profit. These plans, in brief, are as follows:

Middle and South Yuba—These two streams, which have over 60 per cent of the available yardage, will be served by one dam at "Upper Narrows," near Smartville, Yuba County. The site is below the mouth of the North Fork, but that stream is served by the Bullard's Bar dam. The principal districts that will be served are North Columbia, Moore's Flat, North Bloomfield, Blue Tent, Relief Hill, and Omega. It is estimated that there are 388,000,000 cu. yd. of hydraulickable gravel above the dam site.

The design calls for a gravity arch dam 237 ft. high and 97 ft. thick at the base. It will contain 339,400 cu.yd. of concrete and require 174,000 cu.yd. of excavation. Reservoir capacity will be 136,500,000 cu.yd. It is estimated that the "non-mining load" that is the result of natural erosion, and the bringing down of old tailings still retained in the canyons, will amount to 16,000,000 cu.yd. This will give the reservoir a capacity of 118,000,000 cu.yd. of tailings, the remainder of the space constituting a "stilling basin" to check the velocity of the water during flood flow, so that sediment will not be carried over the crest in suspension.

Construction cost of the Narrows dam is estimated at $4,300,000, with capital cost of $4,595,000. Storage cost to repay the expenditures just mentioned will be 3.89c. per cubic yard. It will be noted that as the plan works out the mines will be paying the cost of storing the products of natural erosion which would otherwise be carried into the Sacramento River. Offsetting this is the fact that in computing the capital cost of the dams no interest charges were figured in. The Narrows site has power possibilities estimated at an annual output of 48,154,000 kw-hr. of primary power and 12,436,000 kw-hr. of secondary power, but this is not taken into consideration at present, as it was felt that in view of other power developments the market was not certain.

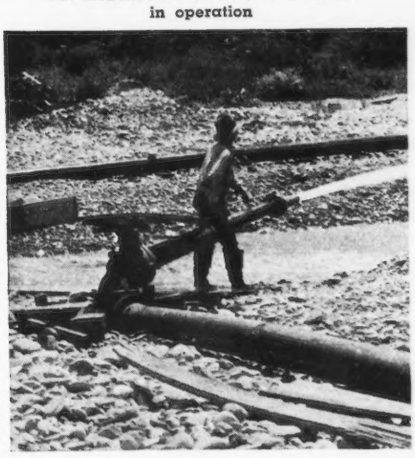
"TAILING" from hydraulic mining operations in the past have filled this canyon to a depth of 125 ft. The photo is reproduced by courtesy of the United States Forest Service



AT THE LAGRANGE MINE, in Trinity County, once the largest hydraulic mine in the world. Three giants are seen in operation washing caved gravel into sluices. Operations were conducted every season from 1874 to 1918, when the property shut down, though not from exhaustion. Photo by courtesy of United States Forest Service

BANKS OF GRAVEL at the Depot Hill hydraulic mine, in Sierra County. This mine has produced some gold every year since 1855. Photo courtesy United States Forest Service

AN HYDRAULIC GIANT, or monitor, in operation



American River—Operations tributary to the American River will be served by two dams, on the North and Middle forks. No storage is contemplated on the South Fork, as the deposits tributary thereto are limited in comparison with the others.

The North Fork dam will impound tailings from Iowa Hill, Gold Run, the north side of Forest Hill, and lesser camps. It will be 2½ miles above the confluence of the North and

Middle forks. The estimated volume of hydraulickable gravel above the dam sites is 87,000,000 cu.yd. The dam will be a concrete arch 139 ft. high and 29 ft. thick at the base, containing 34,600 cu.yd. of concrete and requiring 38,400 cu.yd. of excavation. The capacity of the reservoir will be 27,700,000 cu.yd., of which 26,000,000 cu.yd. will be available for storage. Capital cost is estimated at $900,000, which will make the storage cost 3.46c. per cubic yard.

As to the Middle Fork, the Lower Ruck-a-Chucky canyon site on the Middle Fork controls the deposits at Michigan Bluff and the south side of the Forest Hill Divide, principally Paragon, Bath, and Dardanelles. The volume of hydraulickable gravel above the dam site is estimated at 76,000,000 cu.yd. The dam will be a concrete arch 148 ft. high and 30 ft. thick at the base, containing 34,600 cu.yd. of concrete and requiring 15,900 cu.yd. of excavation. The reservoir capacity will be 24,900,000 cu.yd., of which 24,000,000 will be available for storage. Capital cost will be $750,000, making the storage 3.13c. per cubic yard.

Bear River—Lowell Hill, Liberty Hill, Little York, You Bet, Quaker Hill, and other camps draining to Bear River will be served by a dam at Dog Bar, about 4 miles from Colfax. This dam will be 122 ft. high, with the base 29 ft. thick. It will be of triple-arch design, with two concrete abutments 156 ft. long and 30 ft. wide built into the bedrock for the stream anchorages. It will require 38,400 cu.yd. of concrete and 25,000 cu.yd. of excavation. Reservoir capacity will be 32,150,000 cu.yd., of which 26,000,000 will be allotted to débris storage.

A condition enters into the situation at Dog Bar that does not appear at the other sites, in that the diversion of one of the main canals of the Pacific Gas & Electric Company is above the dam. As some of this water is sold for domestic and municipal use, it will be necessary to install a desilting and clarifying system at a cost of $400,000, more than half of the cost of the dam proper, which is $730,000. The capital cost of the Bear River system will be $1,220,000, which will make the storage cost 4.69c. per cubic yard. This is the highest-cost storage in the system, whereas it would be the lowest if it were not for the special works necessary.

However, no plans for immediate construction on the Bear River are under way, as the miners and the power company have gotten into litigation, and until this is settled construction cannot be undertaken.

The débris dams have been discussed in some detail, as it is obvious that the whole program of reviving hydraulic mining in the Sierra Nevada depends on them. Furthermore, they are of interest in that this is the first instance of the Government's planning the expenditure of any substantial sum directly in aid of the mining industry. The natural question that occurs to one is whether the expenditure will be justified by the financial return from the operations.

Obviously, this feature is controlled by two factors: the amount of gold in the gravel and the cost of recovering it; and it is likewise obvious that any estimate of general costs over the entire area must be taken with broad allowance with respect to the individual mines.

Former Costs Low

Costs in the days when there were no restrictions were remarkably low under competent management. Records of the North Bloomfield show that from 1870 to 1884, 29,870,000 cu.yd. was mined at the average cost of 4.27c.[5] Pierre Bouery is cited[6] as authority for the statement that operating costs at the LaGrange mine, in Trinity County, were 2.8c. on a total of 65,000,000 cu.yd. mined. Similar figures are available from other sources.

In estimating present-day costs in the light of the old figures, many factors must be taken into consideration. As to the actual moving of the gravel, no device has been developed to compete with the giant and no operator to beat the old-time hydraulic miner. Consequently, labor costs are going to be higher than they were when $3 was the going wage for a ten- or twelve-hour day, with no compensation insurance, social security insurance, and like charges. On the other hand, auxiliary expenses have been reduced; hammer drills are used instead of doublejacks, and trucks instead of four-horse teams, and improved highways will tend to offset general increases in the cost of supplies and living. Gasoline or commercial power will release for mining water formerly used to run derricks, light plants, elevators, and such equipment. Recovery will be improved by developments in riffle design, placer jigs, and similar devices. It is the general opinion of most engineers who have studied the subject that present-day costs will compare favorably with old costs and possibly better them. The Débris Commission estimated an overage cost of 10c. per cubic yard, exclusive of storage.[7] At first thought this appears to be high, but it is not so badly out of line if what it covers be taken into account.

The Commission plans a twenty-year operating program. Assuming a flat 10c. as costs plus the storage expense with values per cubic yard as given in Table I, this would work out as shown in Table II.

The figures in Table II show a percentage of cost to output of 71.6, costs including all charges. The cost of producing an ounce of gold would be $25. The annual net profit of $534,000 represents a return of 8 per cent on $6,675,000.

Actual operating costs in recent years are not easy to obtain, as operations have been scattered and, as a rule, of comparatively short duration. Gardner and Johnson[8] give costs of six California mines during the 1932 season covering a total of 1,100,000 cu.yd. at an average of 3.88c. per yard. These costs exclude storage charges on two mines using Bullard's Bar dam. Individual operations were from 29,000 to 719,000 cu.yd., costs at the latter being under 3c. per cubic yard.

In the light of these figures, and considering that, with the troublesome débris question disposed of, the mines will be justified in making investments in larger water supplies which will permit longer operating seasons, it appears that the estimate of the Débris Commission of 10c. including all charges is well on the conservative side.

It is reasonable to assume that operations will not cease at the end of the twenty-year program as at present outlined by the Commission. The sites chosen for the proposed dams are those which afford the lowest storage cost for a safe structure, but with all capital expenditures written off at the end of the period, it will be feasible to build dams at some of the other sites even if they involve a higher storage cost per cubic yard.

In its last survey the Débris Commission gave attention to all possible sites. Some of these were rejected out of hand because of obviously unfavorable conditions, but a consideration of the others indicates that the lives of the mines may be extended from 5 to 32 years by building additional dams.

The extension of operations possible if the other sites are utilized is as follows: Middle Yuba, 5 years at 3,000,000 cu.yd. per year at a storage cost from 6 to 7c.; South Yuba, 15 years at 2,900,000 cu.yd., storage 6 to 7c.; North Fork of American, 32 years at 1,300,000 cu.yd., storage 5c.; Middle Fork of American, 28 years at 1,200,000 cu.yd., storage 5c. The gross production that would be obtained by thus continuing the operations would approximate $25,000,000, making a total of $62,500,000 possible to recover from these deposits over a period of 25 to 52 years.

The Bear River has not entered into the calculations mentioned in the foregoing, as foundation conditions were found unsatisfactory at the three additional sites that were topographically adaptable.

Obviously, water supply will play

an important part in future work. Estimates given have been based on supplies now available without considering the possibilities of future development. Since the Sawyer decision much of the water formerly used for the hydraulic mines has been appropriated by power and irrigation companies and such hydraulic operations as have been carried on for many years past have been dependent on surplus water that could be relied on for only four or five months at best. Even so, there is a great amount lost during the flood season, and now that the débris question is settled, some of the mines are planning storage works that will give them a dependable supply for a considerable part of the year.

In connection with the water rights a question has been raised which may prove important. It has been contended by some in behalf of the miners that they never abandoned their water rights; that, having ceased using them under the duress of court injunction and having stood ready ever since to resume use whenever conditions were such that they could do so legally, they have never forfeited them. As valuable as these water rights would be to the miners, an attempt to enforce them in accordance with the principle just set forth would probably lead to litigation as bitter as that which preceded the Sawyer decision. Now that hydraulic mining is in a fair way to get back on its feet, it is sincerely hoped that such a situation will not arise.

All of the discussion herein presented has been in connection with the Yuba, Bear, and American rivers. Other deposits of lesser volume, but still of sufficient size to be important, are found from Plumas County on the north to Mariposa County on the south. Surveys have shown that suitable dam sites are available for the control of débris from these deposits, and it is expected that with a program of rehabilitation under way on the larger deposits, plans will be made for developing the others.

Klamath-Trinity District—This district embraces the drainage areas of the Klamath River and its tributaries, the Trinity and the Salmon in Siskiyou and Trinity counties. It is little known beside the more picturesque districts of the Sierra Nevada, but, inasmuch as it did not have the débris problems of the latter, operations have been carried on during the years when the larger deposits were idle.

The largest of these mines was the LaGrange, on the Trinity River. Though the deposit was not as great as many in the Sierras, it actually moved more gravel because it had a longer life, due to unhampered operation, and for many years was ranked as the largest hydraulic mine in the world. Its main ditch line was 29 miles long, of which 11 miles were flume. The system had a capacity of 5,500 miners' inches, available at the pit under a 650-ft. head. It operated practically every season from 1874 to 1918 and finally shut down, not because of exhaustion but because a fault made it impossible to keep barren material from sliding into the pit and diluting the gravel so that finally it reached the point where it no longer paid. Gross production is estimated at approximately $8,000,000 from 65,000,000 cu.yd. of gravel.

For some years operations in this district were untrammeled except at some of the larger mines, such as the LaGrange, which found it necessary to buy some of the lands on which its tailings were encroaching. Then an adverse factor entered the situation. This region, the Klamath River section especially, is noted for its beautiful scenery and its salmon and steelhead trout fishing. It attracts sportsmen from all over the country and the "recreation-minded" public, and large sums have been invested in homes, hotels, and camps. The objection was raised that hydraulic mining interfered with fishing. It was another case of the organized minority against an unorganized majority. In 1931 the Legislature passed a bill which closed the streams to placer mining from July 15 to Oct. 15 of each year by prohibiting any rolling of the water during that period. The first bill was not so serious, as most of the mines are dependent on a seasonal water supply and were closed because of shortage between those dates. But, having gotten in an entering wedge, the sportsmen renewed the contest, and in 1936 the State Chamber of Commerce appointed a "fact-finding committee." The committee submitted a report [9] in which it made no recommendations and which is chiefly informative as to the habits of the fish, annual rainfall, and such matters. The chairman of the committee was an aquatic biologist, three of the other four members represented the sporting interests, and the three members of the advisory board were officers of the State Fish and Game Commission. The report included estimates of the capital invested in both mining and recreation as shown in Table III. Figures on mining represent both lode and placer mines, as recent opposition on the part of the sportsmen has extended to all forms of mining débris.

Notwithstanding the figures in Table III, the 1937 Legislature lopped two more months off the mining season, limiting it to Dec. 1st to June 30, but allowing fifteen days in July for cleaning up. Many of the smaller mines are limited by nature to a season within the dates just mentioned, but there are other mines the operation of which will be restricted.

As a matter of fact, the limited season, though inconvenient in some cases, is not fatal. All of the mines that have operated in the Sierra Nevada since the Sawyer decision have done so on "seasonal water," which rarely lasts more than five months in the best season. The total amount of gold recovered will not be lessened, but the number of years in which it can be won will be lengthened and the annual income will be decreased. This will limit the amount that one can spend in the purchase and equipment of a property, but not its ultimate productivity. In the region there are a number of small properties that can be equipped at moderate expense and worked on a small scale. Water supply is usually limited, but the streams tributary to the river have steep grades and a good head can be acquired with a short ditch. As an example, there is one property with 1,200,000 cu.yd. of gravel. One and three-quarters miles of ditch will deliver sufficient water

(*Continued on page 52*)

Table II.—Annual Production and Expected Profits From Twenty-Year Hydraulic Program

Stream	Annual Yardage	Value per Cu. Yd.	Annual Production	Cost per Cu. Yd.	Annual Cost	Annual Net
Yuba	5,900,000	18.2¢	$1,073,000	13.89¢	$819,000	$254,000
Bear	1,300,000	26.6	346,000	14.69	191,000	155,000
North American	1,300,000	19.5	253,000	13.46	175,000	78,000
Middle American	1,200,000	17.1	205,000	13.13	158,000	47,000
Totals	9,700,000		$1,877,000		$1,343,000	$534,000

Total recovery in twenty years, $37,540,000

Total profit in twenty years, $10,680,000

Table III.—Comparative Investments in Mining and Recreation on Klamath River and Tributaries

Mining	
Capital invested	$7,702,315
Proposed future expenditures	2,466,400
Annual payrolls	797,287
Number of employees	729
Recreation	
Investment Camps	$284,000
Homes	557,900
Total	$841,900

Selby Smelter Now Has World's Tallest Stack

New reinforced concrete chimney on San Francisco Bay towers 605 ft. 9 in. above the top of its foundation

CONSTITUTING the major part of a general modernization program inaugurated more than a year ago, the American Smelting & Refining Company has recently completed the erection of what is considered the world's tallest reinforced-concrete chimney at its smelting plant at Selby, Calif. The new stack is 605 ft. 9 in. high from the top of the foundation slab to the crown of the shaft (including a 9-in. ceramic cap), which exceeds by 5 ft. 9 in. the previous record height of 600 ft. of the chimney completed last September at the smelter of the Nippon Mining Company, Chinnampu, Chosen (*E.& M.J.*, Vol. 138, No. 3, p. 124), and its purpose is to discharge the gases from the sintering and acid plants at such a height that they will have a chance to diffuse and thus eliminate inconveniences to near-by residential districts and be less injurious to plant life, at the same time furnishing sufficient draft so as to decrease the need for fans in the different smelting departments. As built, the new unit fulfills the following requirements:

Capacity, 200,000 cu.ft. per min.
Elevation of base—top of concrete base, 3.55 ft. above sea level.
Gases to pass through baghouse.
Maximum and minimum temperature of gases 200 deg. F. and 180 deg. F.
Maximum and minimum temperature of outside air, +105 deg. F. and +24 deg. F.
Draft at base of stack, 0.40 in. at 100 deg. F. outside temperature; 1.53 in. at 30 deg. F. outside temperature (gases entering base at 200 deg. F.)

Field work on the part of the Alphons Custodis Chimney Construction Company, of Chicago, Ill., began immediately after signing of the contract, and careful selection and use of modern equipment are largely responsible for the record time in which the chimney was built—about 244 days.

Excavation of the base, involving 2,440 cu.yd., began Nov. 18, 1936, and was finished in 50 days, with preparatory work for concreting—that is, the placing of forms and reinforcing steel—being started on Jan. 8, 1937. The foundation, containing about 1,021 cu.yd. of concrete, was placed by continuous pouring in three days, using three eight-hour shifts, the work commencing on Jan. 13. It rests on hard, rock-like blue clay, which is good for 8,000 lb. per sq.ft. bearing area, and is octagonal in shape, with an inscribed diameter of 68 ft. and a thickness of 9 ft.

The shaft is designed to withstand the effects of acidic gases within and the combined loadings resulting from its own dead weight and a horizontal wind pressure of 100 lb. per square foot of projected area. Outside diameter at the base and top is 43 ft. 11½ in. and 14 ft. 8 in.; the thickness of the walls at both points is 25 in. and 7 in., respectively. The wall of the 5-ft. crown shown in the accompanying halftone is 10 in. thick.

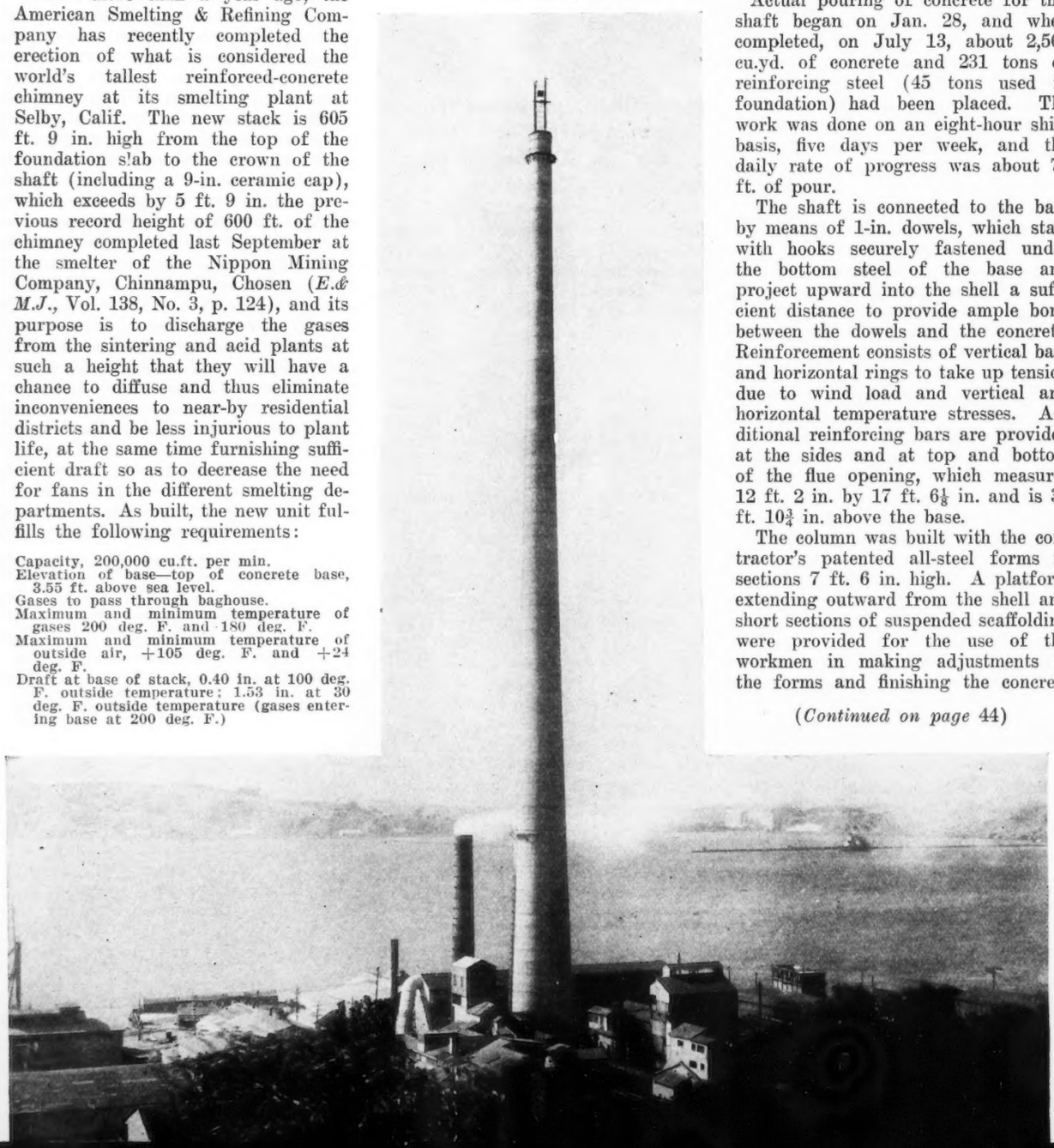
Actual pouring of concrete for the shaft began on Jan. 28, and when completed, on July 13, about 2,560 cu.yd. of concrete and 231 tons of reinforcing steel (45 tons used in foundation) had been placed. The work was done on an eight-hour shift basis, five days per week, and the daily rate of progress was about 7½ ft. of pour.

The shaft is connected to the base by means of 1-in. dowels, which start with hooks securely fastened under the bottom steel of the base and project upward into the shell a sufficient distance to provide ample bond between the dowels and the concrete. Reinforcement consists of vertical bars and horizontal rings to take up tension due to wind load and vertical and horizontal temperature stresses. Additional reinforcing bars are provided at the sides and at top and bottom of the flue opening, which measures 12 ft. 2 in. by 17 ft. 6⅛ in. and is 34 ft. 10¾ in. above the base.

The column was built with the contractor's patented all-steel forms in sections 7 ft. 6 in. high. A platform extending outward from the shell and short sections of suspended scaffolding were provided for the use of the workmen in making adjustments to the forms and finishing the concrete

(*Continued on page* 44)

THE NEW STACK at Selby is reported to be 5 ft. 9 in. taller than the chimney at Chinnampu, Chosen, described in *E. & M. J.*, March, 1937, p. 124



Iron Mining In Muscoda No. 6

Scraper loading . . . Hauling . . . Hoisting . . . Pumping
Compressed-air distribution . . . Ventilation . . . Safety . . . Other operating data

E. M. Ball
General Superintendent

A. W. Beck
Chief Engineer

Tennessee Coal, Iron & Railway Company
Subsidiary United States Steel Corp.,
Birmingham, Alabama

IN PART I, published in the September issue, dealt primarily with the subjects of mine development and stoping method, describing incidentally the evolution of present practice. The second and concluding installment, herewith, continues with a description of present-day scraper loading, haulage, hoisting, and other auxiliary operations.

ALL ORE IS LOADED by double-drum scraper hoists. These are equipped with two loose drums driven through jaw clutches by a 50-hp. direct-current reversing motor. The complete scraper hoist is mounted on standard-gage trucks. It is moved along the track by anchoring the rope from one of the drums and hoisting or lowering the loader as the case may be. The front end of the machine is equipped with horizontal and vertical rollers to guide the rope to the drum face. The scraper hoists weigh 14 tons, and the scraper, which weighs 2,700 lb., has a capacity of approximately 2 tons when loaded.

During its operation the scraper hoist is clamped to the head of the rail. Steel center ropes, $\frac{7}{8}$ in. in diameter, are used on all mechanical loaders. An auxiliary drum is mounted on the end of the loader and driven from the 50-hp. motor through spur-and-bevel gears. A rope from this auxiliary drum is threaded through sheaves at the loading ramp, and handles cars between the loading ramp and the side tracks. (Fig. 9.)

In the mining operation a cycle is maintained between stoping and face driving whereby the face is advanced far enough for a new stope while the operating stope is being mined. This method provides three to five places in which to drill and load. The day-shift crew loads the ore broken by the preceding night shift and drills and blasts ore for the next shift. Ore is scraped from the stopes and advancing faces over steel loading ramps made from 15-in. channels 18 ft. long, bolted together. The toe of the channels is set in a hitch in the footwall, rests on a bent made of 12-in. square timber, and extends over the loading track. One rope from the mechanical loader is threaded through a sheave, suspended from an eyebolt in the face and connected to the back end of the scraper. The other rope is attached to the front end of the scraper. The ore is loaded into 5-ton all-steel tram cars and handled by either the auxiliary drum or an auxiliary electric hoist mounted on trucks to a side track approximately 200 ft. from the loading ramp. From the side track trips of six cars are pulled by 20-ton electric trolley locomotives out of the mining headings onto the main haulageway and to the rotary dump.

Haulage—A car haul installed on the load track at the top of the pocket feeds the loaded cars into the rotary dump. The empties are collected on a side track below the dump, and the locomotives, having been coupled from their loads above the car haul, run around the rotary dump and push the empties back to the working faces.

The 20-ton locomotives are mounted on standard-gage 42-in. diameter trucks and are driven by two 125-hp., direct-current motors. They are equipped with air, dynamic, and hand brakes. Steel trolley shoes are used and the 6/0 figure eight trolley wire is lubricated monthly.

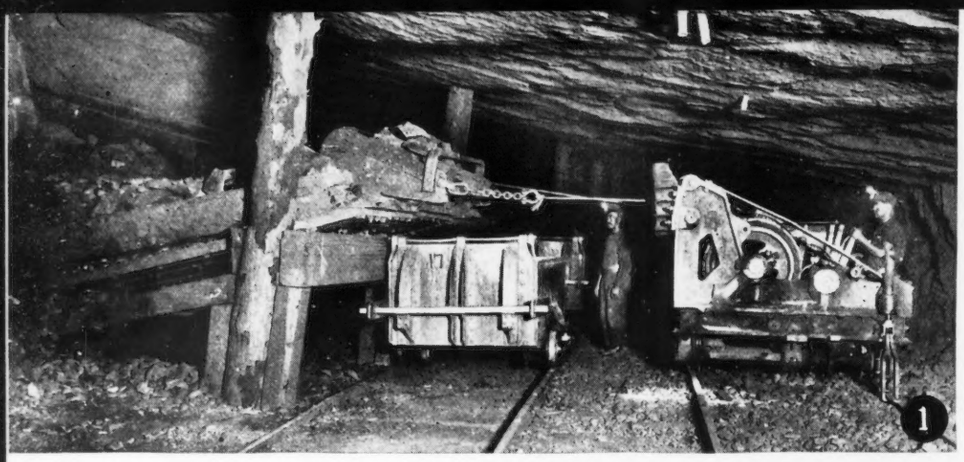
A manually operated block-signal system is in use on the main haulageways. All locomotive engineers are under the supervision of a dispatcher, who routes every trip.

Hoisting—The ore is drawn into a 12-ton measuring hopper from the bottom of the pocket by means of an air-operated undercut gate. The doors in the bottom of the hopper are tripped by an air cylinder. From the measuring hopper the ore is delivered into 12-ton skips and hoisted by the double-drum electric hoist to the surface tipple. The ore passes from the tipple through a gyratory crusher set at 2 in., into railroad cars for shipment to the blast furnaces.

The double-drum surface hoist is housed in a building of brick and steel construction. It is driven by a 1,800-hp., 60-cycle, 2,300-volt, alternating-current motor, operating at 360 r.p.m. through single-reduction gears to develop a hoisting speed of 2,800 ft. per minute. The drums are 12 ft. in diameter with a 5-ft. face, and are wound with 7,200 ft. of 6 x 21 - $1\frac{1}{2}$-in. lang-lay hoisting rope. In addition to the manual controls, the hoist is equipped with automatic speed limit controller and track limit switches. A miniature tipple over each indicating dial is wired to insulated sections of the track in the main tipple. As the skip passes over these sections, it completes the electrical circuit and a light on the miniature tipple shows the actual position of the skip.

The skips weigh 21,600 lb. each and are equipped with three-point suspension, roller-bearing trucks. An average of 12 gross tons of ore is hoisted each trip from the pocket, a distance of 6,260 ft. The minimum safety factor on the hoisting rope is 7.53 for ore and 11.93 for men.

Pumping—Very little water is encountered in actual mining operations. Small gathering pumps located in local depressions throughout the mine deliver water to a sump at the bottom of the slope. From this point the water is pumped by a 100-g.p.m. plunger-type, electric-driven pump up the slope for a distance of 1,550 ft. and into a drain line, which delivers it to a central sump in the adjoining No. 4 mine. It is relayed from this sump by a 500-g.p.m. centrifugal pump to another sump. There is a 1,500-g.p.m. electric-driven, plunger-type pump at this station, which pumps the water to the surface. Water from the upper workings of

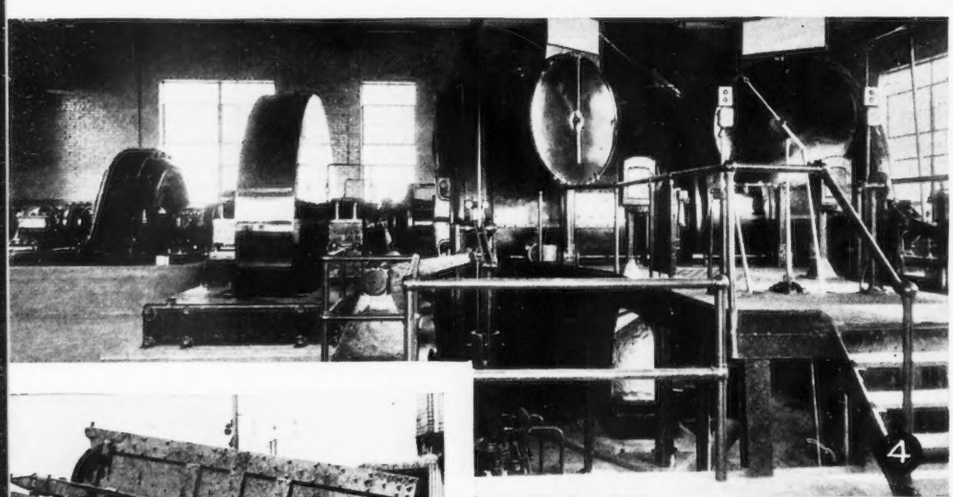


1 MECHANICAL LOADER on a mining level track, scraping from a stope. The scraper is pulled up over the ramp and discharges into the 5-ton car. A close-up view of the loader was shown in the first part of this article, in the September issue, on p. 33.

2 THE SCRAPER RAMP, or slide, seen from the working face of the level. Here the scraper is dragging from the face of the heading, which is being advanced by breast stoping. See the accompanying views.

3 DRAG SCRAPER in operation in a stope in Muscoda No. 6 mine. It weighs 2,700 lb. empty, a weight that aids it in digging into the muck to load itself, as well as in standing up under the severe service.

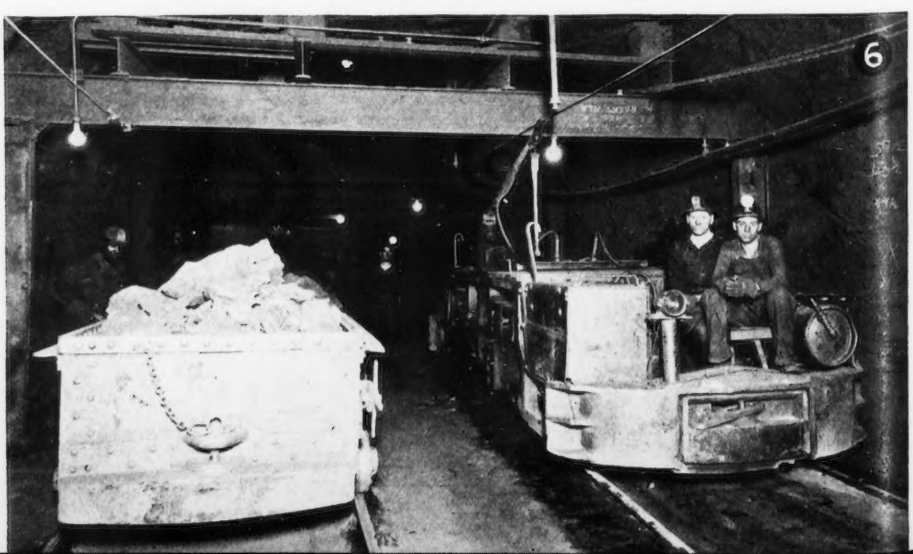
4 IN THE HOIST HOUSE at Muscoda No. 6 mine. The hoist has two 12-ft. (diameter) by 5-ft. drums, each wound with 7,200 ft. of 1½-in. rope. An 1,800-hp. motor drives it. Note the transparency indicators, above the dials, which show various positions of the skip at the dump.

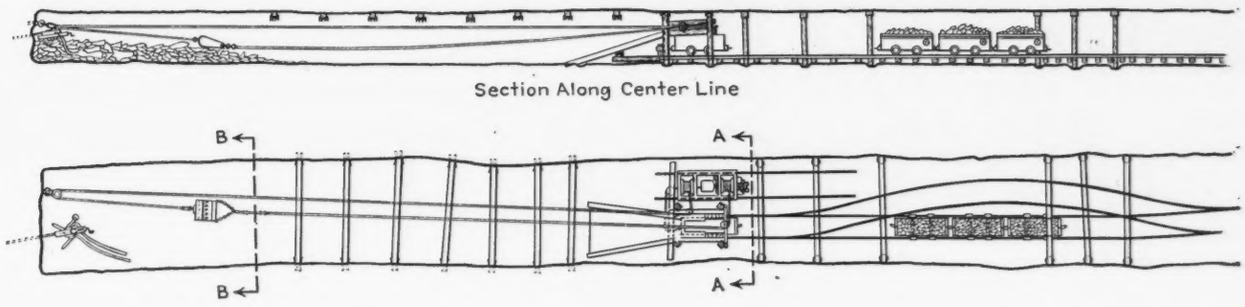


5 A STANDARD ORE SKIP of 12 tons' capacity at Muscoda No. 6 mine. Interesting comparison can be made with the drawing in Fig. 4 (in the first part of the article, in the September issue), which illustrates the means provided for giving hoisting signals.

6 THE ROTARY DUMP, installed at the end of No. 6 slope in 1928, is seen beyond the loaded 5-ton car. It stands over the ore-storage pocket which receives the ore brought in over the haulageways from the distant sections of the mine. At the right is one of the 20-ton locomotives.

7 BARRING DOWN loose roof in Muscoda No. 6. Safe practice is taught and enforced. Daily instructions are given in safety practices.





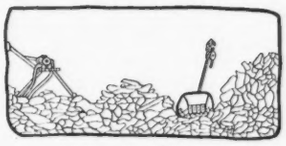
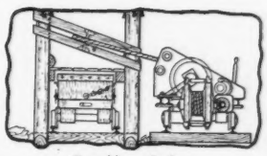

Section B-B

Fig. 9 . . . Scraping Practice followed in advancing headings is shown here. The plan and three sections illustrate the typical arrangement of equipment in Muscoda No. 6


Section A-A

No. 6 mine is collected and drained into a relay sump in the upper portion of No. 5 slope, from which it is pumped to the surface by a 1,750-g.p.m., electric-driven, centrifugal pump. The central and relay pumps at No. 4 and No. 5 slopes handle water for the entire Muscoda Division.

Compressed Air—All compressed air for drilling, chute gates, and air-driven surface-shop equipment is supplied from three electrically driven compressors on the surface. One compressor, located at No. 5 engine house, has a capacity of 5,250 cu.ft. of free air per minute. This compressor is equipped with a five-step, automatic volume control, and delivers air through a 12-in. line into No. 5 mine. This 12-in. line is connected to an 8-in. line from No. 4 compressor station. The No. 4 compressor station contains two 4,000-cu.ft. compressors. An 8-in. line extending from the No. 4 compressor station down the No. 6 slope connects in the lower part of the mine with an 8-in. branch that comes off the 12-in. line extending down No. 5 slope. Main 6-in. and 8-in. air lines extend from the slope out the haulageways into the working sections of the mine. The stopes and faces of the mining headings are connected to the mains by 4-in. and 2-in. lines. Air pressure at the compressor is 85 lb. per square inch. (Fig. 10.)

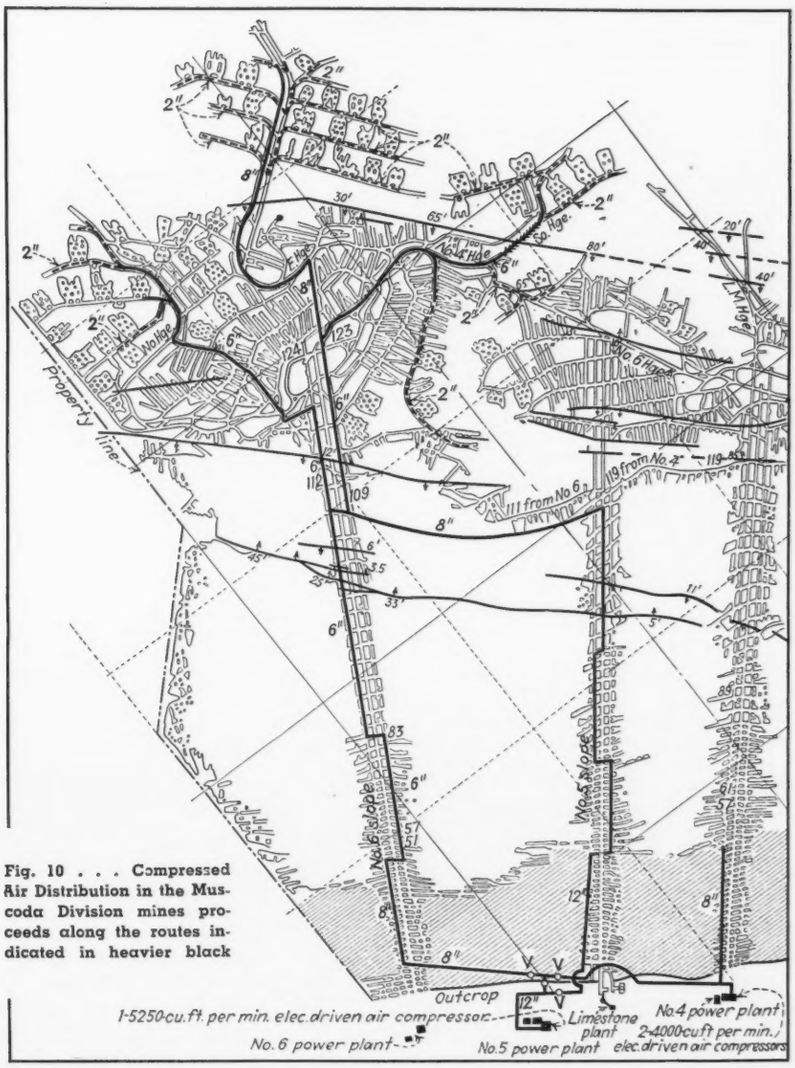


Fig. 10 . . . Compressed Air Distribution in the Muscoda Division mines proceeds along the routes indicated in heavier black

Ventilation—The two ore mines and the limestone mine of the Muscoda Division are ventilated by means of an 8 ft. by 3 ft. 6 in. double-inlet exhaust fan, located on the surface near the portal of No. 5 limestone mine. This fan is exhausting 125,000 cu. ft. of air per minute against a water gage of 3.4 in. It is driven by a 125-hp., 2,300-volt, alternating current motor with an auxiliary 80-hp. gasoline engine as a standby unit. Slopes at the ore mines and the limestone mine are used as intakes. The air current is split at the bottom of No. 6 slope and travels out the three main haulageways to the mining headings, returning through the old workings to an airway parallel to No. 5 slope and thence to the surface. A booster fan is used on the main return at No. 6 mine. Blower fans discharging 2,800 cu.ft. of air per minute through 12-in. flexible tubing are used in each

mining heading to furnish ventilation ahead of the last break-through. (Fig. 11.)

Power Distribution—Power for operating the surface hoist, crushers, and all underground electrical equipment is furnished from a central power house at the Tennessee Coal, Iron & Railroad Company's blast furnaces. It is delivered at 44,000 volts to a 2,500-kva. transformer substation near No. 6 engine house, where the voltage is stepped down to 2,300 volts. Power at this voltage is transmitted into the mine through 600,000 circular-mil, three-conductor, armored cable to the motor-generator station, located near the rotary dump. This station is equipped with two 300-kva. motor-generator sets with automatic controls. Direct-current electricity is supplied through 1,000,000 circular-mil feeder cable to the locomotive trolley system at 250 volts. The feeder cable extends out the three haulageways and connects to the trolley system at intervals of 200 ft. All mechanical loaders, auxiliary heading hoists, and blowing fans are fed from the trolley wire extending into the producing headings. All rail joints are bonded.

The main slope is electrically lighted with 200-watt, 220-volt, alternating-current lamps at intervals of 100 ft. In the main haulageways and in the mining headings 200-watt lamps are connected to the rolley circuit. A floodlight is installed at each mechanical loader for lighting the area around the loading ramps. Carbide lamps are used by the miners.

A mine-type telephone is located at the side track in each working heading. These are all connected to the dispatcher's station near the rotary dump. From this point the lines extend to the skip loading station, the tallyhouse on the surface, and the hoisting engine room. This underground telephone system can be connected to the surface system through switches located in the tallyhouse. When hoisting or lowering men, the skip tender communicates by telephone with the hoisting engineer before the regular hoisting or lowering signals are given.

Operating Statistics—The cost per ton of ore mined, crushed, and delivered into railroad cars ready for shipment to the blast furnaces is divided approximately 70 per cent labor and 30 per cent supplies and power. The table gives a summary of a few interesting statistics of operations, which are averages for the first six months of 1937.

Labor—There is a seven-man crew in each mining heading per shift. The crew consists of a head miner,

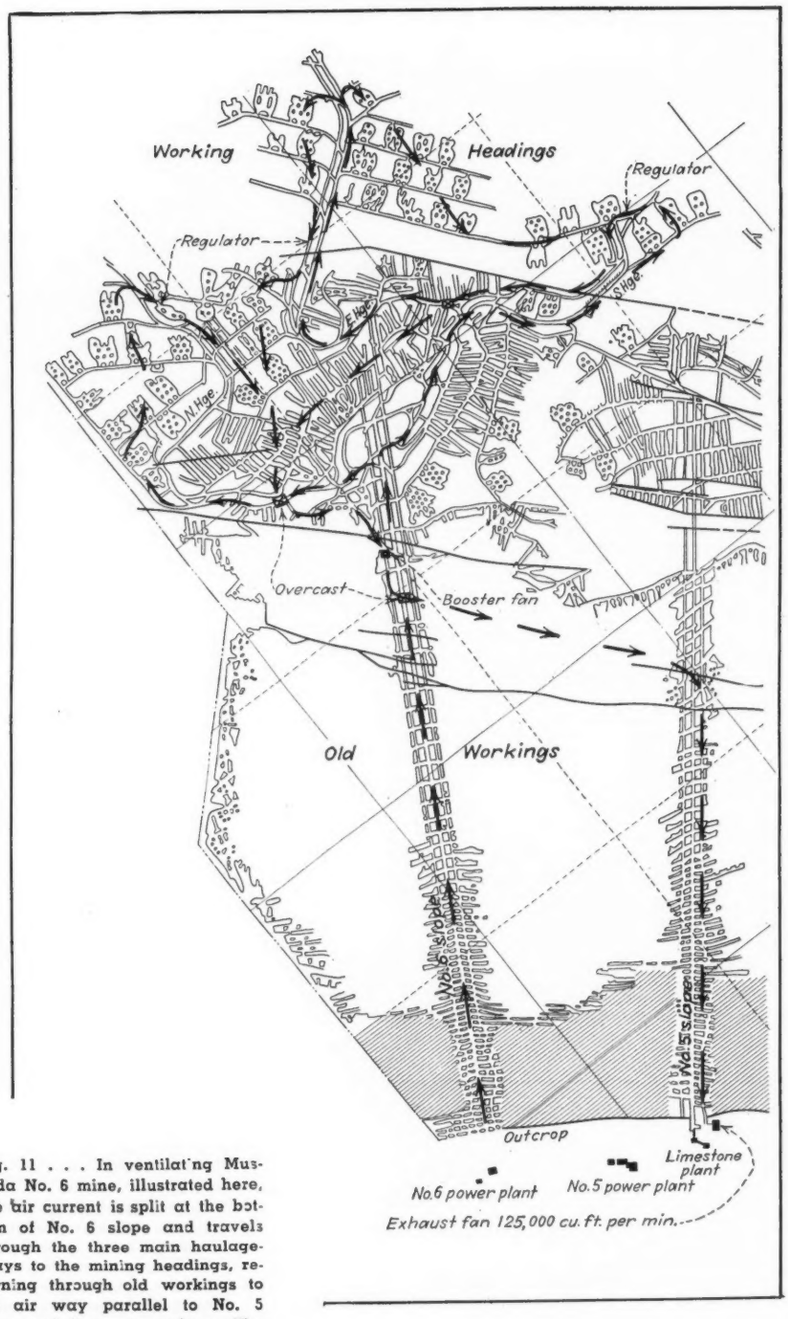


Fig. 11 . . . In ventilating Muscoda No. 6 mine, illustrated here, the air current is split at the bottom of No. 6 slope and travels through the three main haulageways to the mining headings, returning through old workings to an air way parallel to No. 5 slope and thence to surface. The two ore mines and the limestone workings of the Muscoda Division are ventilated by a double-inlet exhaust fan located near the portal of No. 5 slope. The slopes at the three mines are used as intakes

Kilowatt-Hours per Ton of Ore Mined

Scraper operations	1.00
Main hoist	3.98
Crushing	0.47
Compressed air	4.65
Pumping	0.86
Ventilation	0.84

Some Operating Statistics, First Six Months of 1937

Tons of ore per man per eight-hour turn (producing labor)	16.50
Tons of ore per man per eight-hour turn (entire mine crew)	7.11
Tons of ore per pound of explosives	1.50
Board feet of timber per ton of ore mined	0.873
Tons of water pumped per ton of ore mined	15.05
Average number of men per shift	215
Per cent of white employees	65
Per cent Negro employees	35

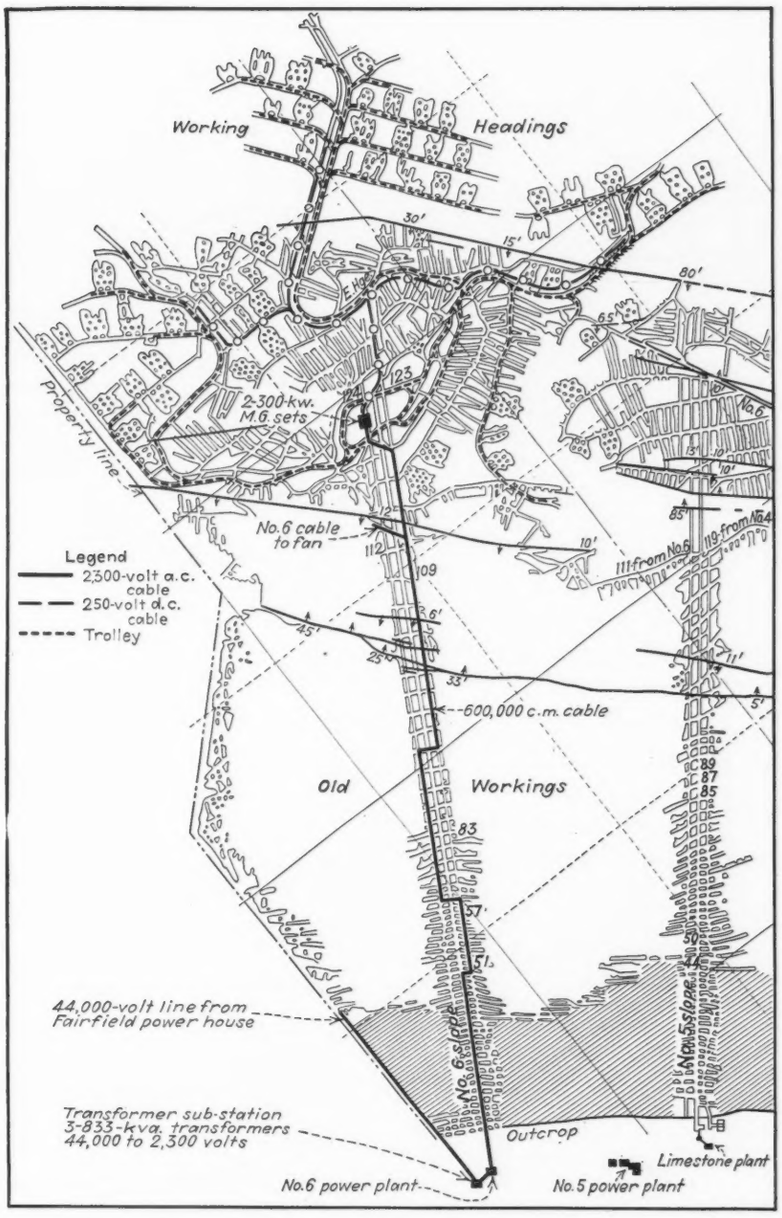


Fig. 12 . . . POWER DISTRIBUTION in Muscoda No. 6 mine is effected as shown. Generated at a central plant near the company's blast furnaces, the power is delivered at 44,000 volts to a substation near No. 6 engine house where it is stepped down to 2,300 volts. At the latter voltage it is sent to a motor-generator station, near the rotary dump. From here it is distributed through the mine

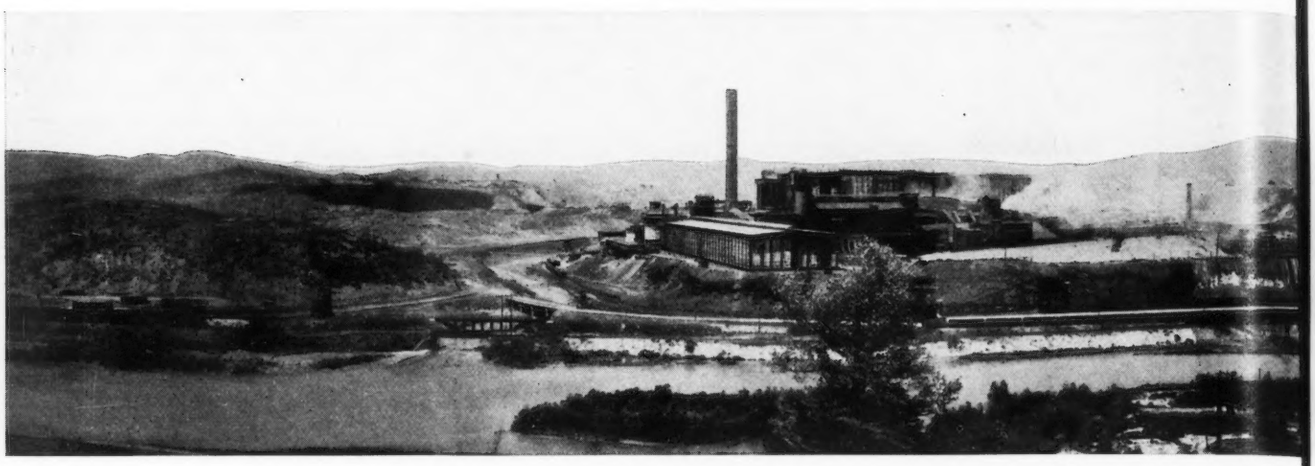
two drill runners, one drag operator, and three section helpers. The night- and day-shift crew in each mining heading work as a unit. An eight-hour turn at the working face is in effect.

All men underground, and the surface hoisting engineer, assistant hoisting engineer, crusher feeders and helpers, and timekeepers, are paid on an incentive system of pay with a guaranteed occupational wage as a base. For the producing crews in the mining headings, a standard number of tons per man-hour was established. When the average tons per man-hour loaded by the day- and night-shift crew in any one mining heading during a pay period exceeds this standard, the payment of bonus begins. The amount of bonus is governed by the increase in tonnage over the standard and is distributed to every man in that mining crew on the basis of an equal per cent increase over his basic occupational rate. It is evident that the incentive earnings of the various mining crews differ. An average is computed for the entire mine at the end of the pay period, and maintenance or service men are given a percentage increase over their basic occupational rate based on this average. In addition to the incentive pay for the increased tonnage for the producing crews, the head miners and drill runners are paid a bonus on the tons of ore broken per pound of powder in excess of a predetermined standard.

Safety—After each man is employed, and before he actually starts work, he is given a talk by the mine superintendent in which safety is emphasized. Upon reporting to the mine for work he is placed in a crew under a foreman thoroughly experienced in handling new men, where he is given special supervision and instructions. Throughout the mine, each crew foreman is responsible, first, for the safety of his men, and gives daily instructions on safety. The mine foreman and assistant, in their daily inspections, examine all places for unsafe conditions and practices. Inspections are made regularly by the mine inspector and his assistant, who report conditions of the mine to the management. Workmen reported for unsafe practices or violations of safety rules are disciplined by the superintendent either through reprimand, temporary suspension from work, or discharge. All foremen, subforemen, and head miners attend a meeting each month with the mine superintendent. At this meeting any accidents that have occurred are thoroughly discussed and suggestions are made for the future prevention of accidents. Suggestions are likewise made and discussed for the improvement of operations. A regular program of first-aid training is followed. Classes are held in the mine office and those selected for the training in first aid and accident prevention are paid for their attendance.

The service of the local company physician or the use of the Employees' Hospital is optional with the employee. Those desiring this service pay a small monthly fee, which entitles them to dispensary service for themselves and their families and to hospitalization at the Employees' Hospital at a reduced cost. Employees living more than 2.5 miles from a company dispensary are required to pay for each visit of the doctor. Physicians are on call 24 hours each day. An ambulance is kept at the local dispensary for emergency use.

In the event of an accident in or around the mine, the injured person, after receiving first aid by fellow workmen, is sent to the local dispensary, where he is given emergency treatment. If the accident is of a serious nature, the patient is immediately taken to the Employees' Hospital at Fairfield.



Tennessee Copper Works Toward Maximum Economy

From its massive sulphide ores it is recovering not only the copper and sulphur but also the long-wasted zinc and iron as commercial products and in addition sells considerable slag. . . .Only one blast furnace remains out of seven formerly used, and, with the roasters, it serves the acid plant

BOTH crude ore and copper concentrates are received at the Tennessee Copper Company smelter. The former is smelted in a blast furnace and the latter directly in the converter which treats the matte from the furnace as well as flue dust and certain scrap copper. Tonnage handled at present consists of 550 tons of ore and 80 tons of concentrates per 24-hour day. This is yielding a monthly output of 1,500,000 lb. of copper, which, save for approximately 300,000 lb. used monthly for making copper sulphate, is shipped to the Nichols refinery in Long Island City, New York.

Requirements of the sulphuric acid plant govern the smelter practice. Of the gas delivered to the acid plant, 60 per cent comes from the roasters, 25 from the blast furnace, and 15 from the converter. These figures are subject to change. It would be advantageous if blast-furnace smelting, formerly a much more important part of the plant practice than it is today, could be done away with altogether, inasmuch as the iron in the ore thus treated is thrown on the slag dump instead of being sold eventually as a sinter, as is done with the iron in the concentrates. Before this can be accomplished, however, it will be necessary to increase the respective capacities of the concentrator and the roaster plant, as well as to provide another way of smelting the copper concentrates, perhaps in a reverberatory.

Ore received from the mine is stored in bins of 3,000 tons' capacity, from which it is drawn as required for making up the blast-furnace charge. The total burden is approximately 650 tons per 24 hours. Of this 500 tons is ore from the Burra Burra and Eureka mines, 50 tons ore from the Fontana mine, 6 per cent is coke, and the remainder quartz flux. About 80 per cent of the total is derived from the Burra Burra mine. The average charge runs approximately 2.5 per cent copper, 25 per cent sulphur, 33 per cent iron, and 18 per cent silica. Fontana ore is higher in grade than the other ore and averages about 7 per cent copper, 23 per cent iron, and 18 per cent sulphur. It contains talc, however, and is harder to smelt. The lime and magnesia will run about 7 per cent, compared with 1 per cent in the Burra Burra ore.

The single blast furnace, now the sole survivor of seven in 1916, is 22 ft. long and 4 ft. 8 in. at the tuyeres. Its capacity has been increased considerably above that of former years when more furnaces were in operation, and may be regarded as 1,000 tons per day maximum, this being the peak that was attained in the latter part of 1929. At present it is running with a 16-ft. column and a 30-oz. blast.

A copper matte running approximately 12 per cent copper and 24 per cent sulphur is made and is tapped in accordance with converter requirements from the 30-ton settler used, and is delivered to the converter department. Its further reduction will be discussed later.

Slagging proceeds continuously. Two practices are followed in respect to slag disposal: On two shifts the slag is washed and granulated in a launder which delivers it to an elevator that discharges into a tank from which it is hauled to the dump. Some of this is screened and sold for roofing and cement purposes On the third shift, the slag is run hot to the dump in pots. Here, by means of spraying water on the face of the

LOOKING NORTH FROM GEORGIA at the smelter and acid plant of the Tennessee Copper Company at Copperhill, Tenn., situated on the boundary line between the states which are here separated by the Ocoee River. The latter's waters find their way into Hiwassee and thence into the Tennessee. A short distance east is the North Carolina line. In the distance, five miles to the north, is Ducktown, with the Burra Burra mine, the company's largest

dump, it is caused to break in coarse pieces, after which it is reclaimed with a power shovel, crushed in a jaw breaker, and screened.

The crude ore, which is smelted direct, as just described, is obtained by hand-picking from the run-of-mine ore (about 55,000 tons per month is hoisted) prior to concentration. The balance is concentrated in the company's two flotation plants at London and Isabella respectively. About 80 per cent of the total ore produced is thus concentrated, this including the total output from the Isabella mine. The two plants produce three concentrates, of copper, iron, and zinc, respectively. The zinc concentrates (containing 50 per cent zinc and made from heads running less than 1 per cent zinc) are sold, as made, to a plant in Pennsylvania. The iron concentrates are roasted to convert their sulphur into gas for acid-making, the resultant calcine then being sintered and sold in the Birmingham district in Alabama. Copper concentrates are smelted directly in the converter together with the matte made by the blast furnace.

Converting is done in one 12x25-ft. Peirce-Smith converter which runs continuously save for about two weeks in the year when it is shut down for relining. A Great Falls-type unit, which serves as a standby, is used while this is being done. The practice of smelting in the converter was begun in 1922, since which year there has been no fundamental change. Today, however, the concentrates thus treated run 20 per cent in copper, compared with 12 per cent at the outset.

Eighty tons of copper concentrates and 120 tons of matte are treated in the converter per 24-hour day on the average. In addition, approximately 20 tons of flue dust and 10 tons of scrap, such as the fines of the shot copper made for copper sulphate manufacture, are also charged. An approximate analysis of the concentrates is: copper, 20 per cent; iron, 35; sulphur, 35; SiO_2, 3.5; and zinc, 2 per cent. The matte, as previously stated, runs approximately 12 per cent in copper and 24 per cent in sulphur.

The cycle of operations is approximately as follows: Each morning, after pouring copper made in the preceding 24-hour run, 20 tons of matte is charged and blown for 20 minutes. Then four 4-ton charges of concentrates are added at 20-minute intervals. Then without waiting until all the concentrates are melted, 5 tons of quartz is added as flux. Two hours after this charge is melted, slagging begins. The operation described is now repeated about six to seven times, the white metal being steadily accumulated until the following morning, when the blister copper is poured. As the white metal builds up, less concentrates are charged by reducing the number of charges per cycle, so that the 16:20 concentrate-matte ratio falls. A blister copper of plus 99 per cent grade is made.

Concentrates are charged with a Gar gun, the matte is charged molten from the ladle, and the quartz flux in a boat through the mouth. The flux, which is well-decomposed float quartz brought in and sold by farmers of the adjoining region, is first crushed in a jaw breaker. Such quartz is said to be more satisfactory than the freshly quarried quartz that was formerly used.

The converter slag contains approximately 1½ per cent copper, 21 per cent silicia, and 53 per cent iron. It is sent to the settler of the blast furnace.

A blast of 10 to 14 lb. per square inch is used on the converter. A constant-volume regulator is used to hold the amount of air to a maximum of 12,000 cu.ft. per minute, for the benefit of the acid plant. If tuyere resistance builds up, the volume may be less than this. The tuyeres are punched about three-quarters of the time.

The converter is lined with 13 in. of unburned magnesite, except for a strip 5 ft. wide along the tuyeres running the full length of the furnace, which is lined with 20-in. brick. On starting after relining, a magnetite lining is blown on top of the magnesite by blowing matte and oxidizing the sulphur until the magnetite freezes on the brick. The tuyere lining lasts approximately one year; the rest of the lining indefinitely.

On pouring—once a 24-hour day, as previously stated—the blister copper is cast in 350-lb. cakes, which are trimmed, sampled, and shipped to the refinery. The molds are carried on a steel frame supported on trucks, which passes under a water spray. Approximately a ladle and a half is thus cast daily.

Of the blister made, about 300,000 lb. per month is used to make shot copper for conversion into copper sulphate. Shot copper is made in the converter department by pouring the molten metal into a tank of water. The shot is discharged from the tank over a screen with ½-in. round holes. Undersize is returned to the converter.

Roasting the Iron Concentrates—The iron concentrates produced in the flotation plant are delivered to storage bins at the smelter. An approximate analysis is: Iron, 54 per cent; sulphur, 40 per cent. Roasting is done down to approximately 6.5 per cent sulpher in ten 22 ft. 6 in. seven-hearth Wedge roasters, which have each a drying hearth in addition. Rabbles revolve at 1 r.p.m. and have water-cooled cast-iron arms. Waste water from the acid plant is used for cooling. Maximum roasting temperature is 1,650 deg. F. The temperature on the seventh hearth is approximately 1,000 deg. F. The off-take gas has a temperature of about 1,200 deg. F. and contains 8 per cent SO_2.

At the moment of writing the roasters are not running at full capacity on account of the lack of adequate dust-collecting capacity. At present, dust is being collected only in flues and the maximum amount of dust is already going to the acid plant, where it not only gives trouble mechanically but causes a loss of acid, one ton of dust consuming something like 8 tons of acid. Three of the roasters are equipped with Sirocco collectors, but the rest discharge through a settling chamber to the flue. The dust re-

claimed in the Sirocco collectors goes with the calcine to the sintering plant.

At present the calcine is trammed by an electric locomotive to the sintering plant, where it is cooled from 1,000 deg. F. to 200 deg. F. in a 60-ft. rotary cylinder having spiral flanges on the inside surfaces. Water is sprayed on the calcine at the feed end sufficient to cool it, as stated, and give about 14 per cent moisture in the cooled calcine. A concurrent draft takes the steam up a stack at the discharge end. The cooled calcine is elevated to a 200-ton storage bin. A new means of handling the calcine is now being installed. It provides for washing the calcines into concrete tanks, where they will be dewatered by decantation and the calcine then removed by an overhead crane and clamshell and stored on the ground near by in the open. Storage room for 7,000 tons is planned. From this storage the calcine will be loaded by the clamshell on a conveyor that will run to the sintering plant.

Sintering is done on a 60-in. Dwight & Lloyd machine, 66 ft. long and having 89 pallets. A 7-in. bed is maintained. An oil-fired arch-type muffle having one high-pressure burner on each end serves for ignition purposes. The charge, which runs only 4 per cent sulphur (the calcine from the roasters runs 6.5 per cent), because of dilution with return sinter and fuel, is roasted in one operation to 0.05 per cent sulphur.

The charge for the sintering machine is made up from a series of five bins, three of which contain calcine, one contains return sinter, and one breeze coke which has previously been crushed in rolls to minus-10 mesh. Each bin delivers via a table feeder onto a conveyor that serves all the bins. All ingredients of the charge thus gathered are elevated to a barrel-type mixer having spiral flanges on its inner surface. The charge consists of 60 per cent calcine, 40 per cent return sinter, and coke equivalent to 5 per cent of the sintered product. The mixer discharge is screened, the oversize then going directly on the pallets with the finer material on top. Even distribution is secured by a swinging chute.

Near the discharge end of the machine a spike roll is suspended over the charge and so arranged that it can be pressed down into the sinter and break up the cake when a large proportion of fines is needed for return sinter.

A 24-x108-in. (diameter) fan driven by a 500-hp. motor serves the machine. Dust is collected in a cyclone. Dust that occurs in the discharge of the sinter rises by natural draft into an overhead scrubber.

The present sintering plant was built in 1935, replacing an older Greenawalt installation. A little harder sinter with less fines is obtained and less dust on dumping.

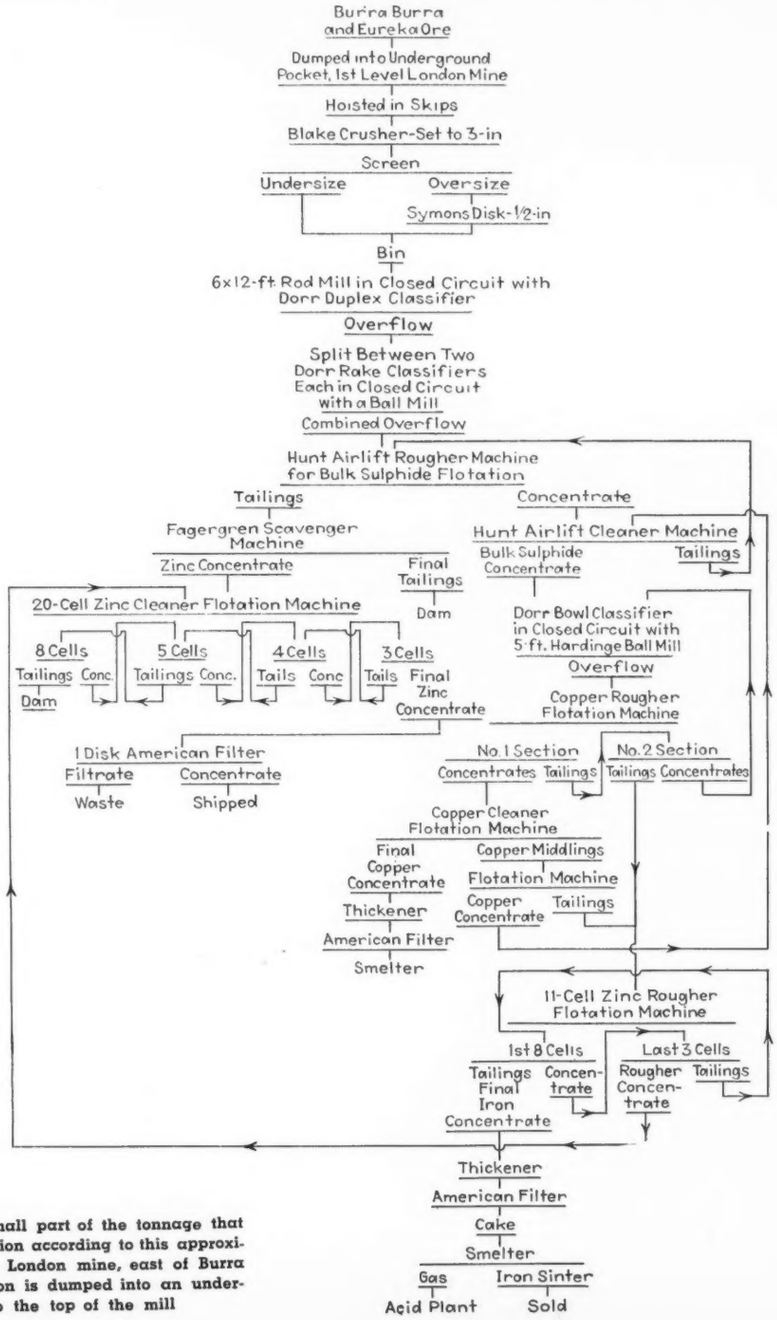
London Flotation Plant—Flotation as practiced by the Tennessee Cooper Company is best illustrated by the procedure at the London plant, which treats the ore from the Burra Burra (and Eureka) mine. From the heavy mixture of copper, iron, and zinc sulphides, three concentrates containing the respective metals are made, two of which are subsequently treated at the smelter, and the third—the zinc concentrate—is sold direct. The mill practice is shown in the accompanying approximate flowsheet. Tonnage milled is 1,250 daily. The plant operates six days per week.

Reagents used are as follows:

Bulk Flotation: potassium ethyl xanthate, Risor pine oil, and sulphuric acid.

Copper Flotation: Crude calcium cyanide, lime, both added to the regrind to depress the zinc and iron. Potassium ethyl xanthate, added to head of machine, to activate the copper. Enough oil is carried over from bulk flotation.

Zinc Flotation: Copper sulphate (to activate), lime, potassium ethyl xanthate, No. 5 steam-distilled pine oil, and No. 634 Barrett.



BURRA BURRA AND EUREKA ORE, save for the small part of the tonnage that is smelted directly at Copperhill, is treated by flotation according to this approximate flowsheet. The flotation plant stands at the London mine, east of Burra Burra and now shut down. Ore received at London is dumped into an underground pocket and hoisted up the shaft to the top of the mill

A Grinding Mill With Micarta Bearings

Lower frictional properties and water lubrication found to be advantageous

Harlan F. Horne
Industrial Division
Westinghouse Electric & Manufacturing Company
Trafford, Pa.

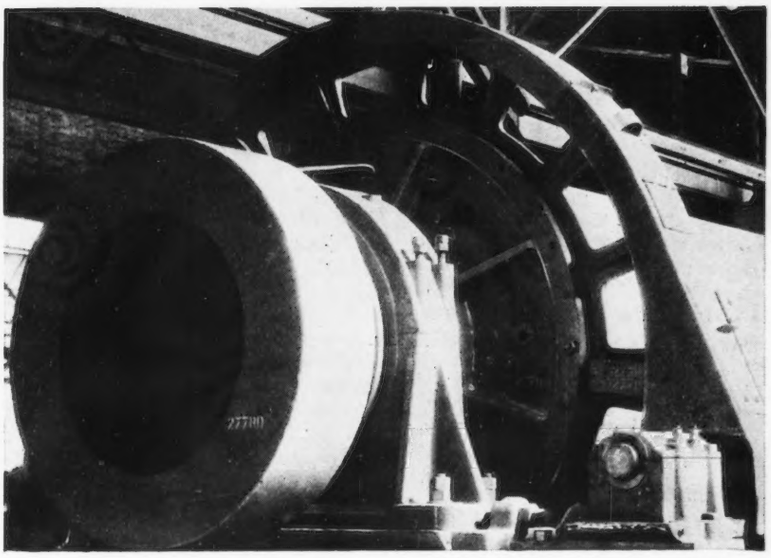


Fig. 1—The lower segment of the 44-in. bearing on this 6x12-ft. rod mill is of Micarta lubricated by water

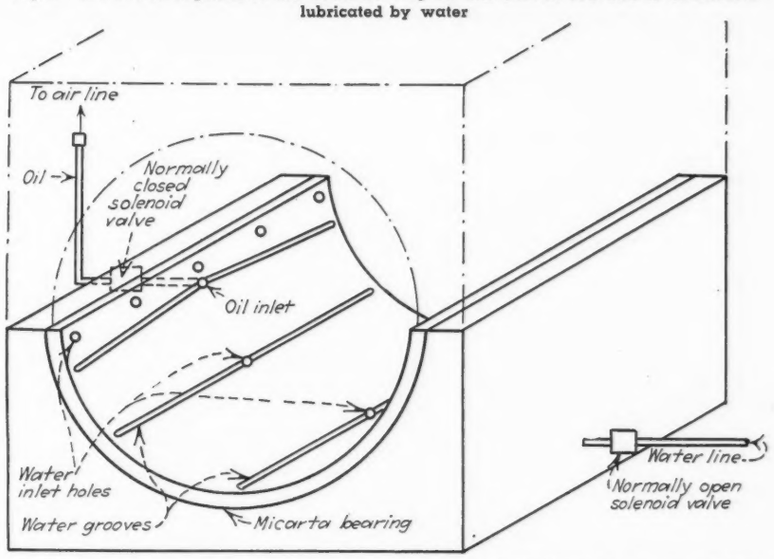


Fig. 2—Oil is automatically introduced at the time of a shutdown by means of two solenoid valves, one open for the water and the other normally closed for the oil

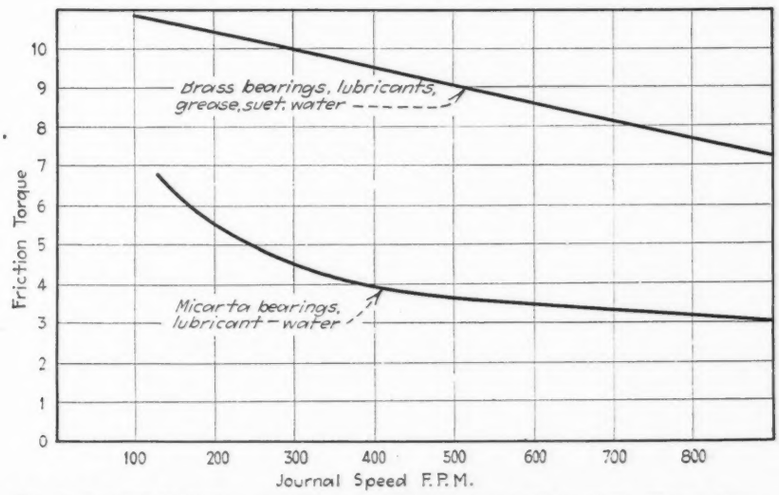


Fig. 3—A graph indicating comparison of frictional characteristics of the Micarta bearing and metallic bearings

CONVENTIONAL metal bearings as used on the various kinds of rod and ball mills sometimes offer serious maintenance problems. In addition, several types of material requiring grinding are handicapped by contamination from the oil or grease used as lubricant. The lower frictional properties of laminated bearings and their use with water lubrication have corrected these difficulties on several grinding mills, ore grinders, and other machinery used for similar types of work.

The first application of "nonmetallic" bearings to this service was made this year for a 6x12-in. Marcy rod mill (Fig. 1), subsequently shipped to an Eastern mining unit refining zinc ore. The bearings on the large end of this mill are 44 in. inside diameter, with a 1-in. wall, and on the smaller end 22 in. inside diameter, with a 1-in. wall. Only a 180 deg. bottom segment is used on each end. The bearings are water lubricated and have operated satisfactorily since installation. Although this mill is almost twice the capacity of mills formerly used with metallic bearings, power consumption is running less than for the smaller units, as predicted by the comparative frictional curves shown in Fig. 3.

On each bearing there is between 70,000 and 80,000 lb. pressure, giving a unit pressure of approximately 150 lb. per square inch. The speed of rotation is 18 r.p.m., or approximately 207 ft. per minute on the periphery of a 44-in. diameter bearing. A total of 50 gal. of water a minute is applied to the two bearings. Part of this water is introduced at the top near the chamfer and a part through a pipe connection in the exact bottom center of the bearing at the working surface.

It was found necessary in this installation to introduce some oil at the top chamfer previous to or immediately following a shutdown, to prevent neck rusting. This is because of the somewhat higher starting torque always present with a Micarta bearing used with water lubrication. A

plan has been devised, however, for using a hydraulic lift arrangement to raise the shaft sufficiently to start turnover on the mill. In many installations, the mills are driven through a clutch arrangement which enables the motor to be brought up to speed before engaging, thus easing the starting load on the motor.

Oil or grease contamination is usually serious in the grinding of ores and prevents proper functioning in the subsequent flotation process. Of course, the Micarta bearings in use on this mill have eliminated the necessity for regular use of oil or grease and resulted in less waste and a material saving in power-consumption and increased bearing life.

Another problem is the maintenance of metallic bearings in certain mills where dust is present and acts as an abrasive and mixes with the grease employed for lubrication. The results are high friction, scored necks and bearings, and overheating. The use of water overcomes this by constantly washing the bearing surfaces. Micarta bearings have been applied on several large cement grinders with neck sizes ranging from 20 to 22 in. The speed on this type of mill is generally around 24 r.p.m., and the pressures total several thousand pounds. However, the bearing design is usually ample, so that the unit pressure seldom exceeds 150 to 200 lb. per square inch. This is light duty compared to some of the applications of laminated bearings in steel mills where unit pressures may reach 8,000 lb. per square inch. The lowered friction and constant removal of dust by the water lubricant makes for longer bearing life, elimination of scored necks, and lower power consumption.

In this type of installation it was desired to introduce oil automatically at the time of a scheduled or emergency shutdown. This was arranged by means of two solenoid valves, one normally open for the water and the other normally closed for the oil. When a shutdown occurs, the water valve closes and the oil valve injects two or three gallons of oil into the working area of the bearing. This oil film enables easy starting of the mill, and the closing of the water valve prevents this oil from being washed out of the bearing. Sometimes it has been found practical to operate bearings at the speeds and pressures with oil lubrication previously mentioned. The only place where this type of lubrication would appear to be of advantage would be where the service was very intermittent and starting and stopping were frequent.

▼

The Selby Smelter

(*Continued from page* 34)

surface. The forms were periodically raised by chain blocks suspended from the "hammerhead" crane arrangement on top of the steel tower carried about 50 ft. in advance inside the chimney, and concrete and men were hoisted to the operating platform by a skip operating in the center of the tower. The skip was actuated by an electric-driven hoist.

Concrete used in the first 67½ ft. of the shaft is a 1–2.4–3 mixture, or given in detail, 1 part of cement, 2.4 parts of washed and screened sand, 1.4 parts of high-quality gravel ranging in size from ½ to ⅞ in., and 1.6 parts of gravel from ¾ to 1½ in. in size. The mix for the remainder of the shaft was carefully regulated to secure a uniform quality of concrete. In other words, the amounts of coarse aggregates were decreased and the fine material was increased as the shaft advanced, because of the walls' decreasing in thickness as the height increased. (It was also found that as the coarse aggregate was decreased, a more uniform strength was obtained on strength tests of test cylinders broken.)

For the concrete foundation a 1–3–5 mixture was used. As a protection against gases, the inside of the shaft was given three coats of sodium silicate and two coats of No. 73 black Gilsonite paint. The exterior of the upper 300 ft. will be given two coats of black and orange Gilsonite paint, to be applied in alternate horizontal bands 30 ft. high for the orange and 15 ft. for the black.

To provide access to the interior of the shaft a clean-out door is available at the base, and at a level 150 ft. from the ground there is installed a steel platform extending around one-third the circumference of the shell. At this point readings and samples of gases can be taken through openings in the chimney. The platform can be reached by way of a steel-guarded ladder that extends the entire height of the shaft.

Lightning protection consists of six lead-covered copper rods each extending 5 ft. above the crown of the stack and securely anchored with copper-bronze anchors. The rods, made of hard-drawn copper and lead covered, are ¾ in. in diameter. Each rod is connected to a ⅝-in. stranded lead-covered copper circuit cable extending around the top of the stack. This circuit cable in turn is attached to three ⅝-in. stranded copper cables carried down the stack, equally spaced and securely fastened to the stack by copper-bronze anchors placed with 7½-ft. centers. Intermediate encircling cables are spaced at 50 ft., center to center. The three down-leading cables are connected to copper-covered grounding rods ¾ in. in diameter and 12 ft. long, equally spaced and set in the ground to a depth of 10 ft. The upper 35 ft. of the lightning rod system is lead covered.

The chimney was designed and built under contract by the Alphons Custodis Chimney Construction Company, of Chicago, Ill.

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Xanthate-Soap Flotation Promising For Recovery of Coarse Oxidized and Native Copper

AN UNUSUAL COMBINATION of xanthate and soap flotation has been developed at the Michigan College of Mining and Technology, at Houghton, Mich., according to C. T. Eddy, director of metallurgical research. With this process, very coarse oxidized and native copper are readily floatable. In addition, the copper-bearing gangue minerals are floated and reground and the barren gangue is rejected at a coarse size—a considerable saving in grinding costs being made possible by this procedure.

Briefly, the process consists of grinding to pass 35 mesh; classification of the ground ore to produce sands and slimes; flotation of the slimes with the usual quantity of xanthate and very small amounts of oleic acid and fuel oil; and flotation of the sands with xanthate to produce a finished concentrate, followed by treatment with oleic acid, fuel oil, and soda ash to float first mainly copper oxide and then copper-bearing gangue minerals. The copper oxide concentrate is returned to the xanthate flotation, where the oxide is again floated and the gangue is largely depressed. The copper-bearing gangue concentrate is returned to the ball mill, where it is reground to liberate the copper minerals.

Batch and continuous tests have shown that the copper in the old weathered tailing in this district can be satisfactorily recovered by this process. The process undoubtedly will also be of interest in connection with other ores which contain both oxidized and unoxidized valuable minerals. A more complete discussion of this subject will soon be published.

How to Design Small Wooden Ore Bins

Application of engineering knowledge to such tasks will generally yield much better results than would otherwise be obtained

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NO PROBLEMS of unusual difficulty are presented in the design of wooden ore bins of moderate capacity. An inspection of available data suggests that probably most small- to medium-sized bins are not designed, but are "thrown" together out of the largest obtainable material, the object being to make them of sufficient strength to preclude any chance of failure. This may be commendable, but it is also often wasteful and may even result in the failure of the bin.

When it is possible to obtain it, dry timber should be used. Wet or green timbers will pull the joints apart after drying. They also have only about 50 per cent of the unit working stress allowed seasoned material. All calculations may be made with the slide rule.

There are two conditions under which a bin may be loaded: level-full and surcharged. A bin level-full is one where the contents do not extend above the top of the bin. This is the type invariably found in service around mines and mills. It is the simplest to design and is satisfactory for practically all requirements. Only the level-full bin will be discussed. In the surcharged bin the ore is stacked above the top until the angle of repose is reached.

Refined calculations should recognize the effect of friction in the movement of the bin contents. For practical purposes this would entail an unnecessary amount of detail. The procedure whereby friction is ignored gives stresses somewhat higher than actually exist. The error is on the safe side and, therefore, gives an added factor of safety.

In designing the bin the initial step is to decide on the dimensions. This decision is influenced by the required capacity, the angle of repose of the ore (this will decide the slope of the bottom if a self-discharging bin is wanted), the available space in which to build the bin, slope of ground surface, necessary clearance between chute lip and ground or floor, type of receptacle bin is discharged into (truck, mine car, belt conveyor, crusher), and related factors.

To illustrate a simple and satisfactory method of design, a bin to fulfill the following conditions will be selected:

1. Capacity, tons 100
2. Slope of bottom (from horizontal), degrees 42
3. Weight of 1 cu.ft. of crushed ore, pounds 100
4. Angle of repose, degrees.... 38
5. Bin to discharge into a 20-cu.ft. mine car.
6. Material of construction, Douglas fir.
7. Bin to rest on concrete footings.
8. Allowable working stresses of material used:

Wood

Compression (as columns), P/A = 1,200 $(1-L/60d)$ lb. per sq.in.

Compression (as columns), $L<15d$, 900 lb. per sq.in.

Compression, end bearing, 1,200 lb. per sq.in.

Bending in outer fiber, 1,400 lb. per sq.in.

Bearing, perpendicular to grain, 300 lb. per sq.in.

Shear, parallel to grain, 170 lb. per sq.in.

Where,

P = load column will support, lb.
A = cross-sectional area of column, sq.in.
L = length of column, in.
d = least side, in.

Steel

Tension in rods and bolts, 16,000 lb. per sq.in.

Bending for bearing plates, 20,000 lb. per sq.in.

Fig. 1*a* shows the dimensions of an end section. The length is 15 ft. inside. The capacity of a 1-ft. thick section is

$$1\times100\times5.7\times12 = 6{,}840 \text{ lb.}$$
$$1\times100\times10.8\times12/2 = 6{,}480 \text{ lb.}$$
$$13{,}320 \text{ lb.}$$

The capacity of the bin $= \frac{13{,}320\times15}{2000} =$ 99.9 tons.

For convenience, the stresses resulting from the forces represented by a "slice" of ore 1-ft. thick are used. This force must be resolved into components which will give the stresses acting in the front and back posts; the beams supporting the floor; the diagonal posts supporting the beams; the sills connecting the front and back posts and supporting the diagonal posts; the tension rods (tierods); the floor planking; the concrete footings; and various bolts holding the members together.

In Fig. 1*a* is shown a graphical and analytical method for determining the stresses in the bin. The forces[1] N and N_2 are found from

$$N = 1/2\, w\, h^2 \left(\frac{1-\sin\theta}{1+\sin\theta}\right)$$

They act at the center of pressure which is $2/3h$ and $2/3h_1$ measured from the top of the bin.

w = the weight of 1 cu.ft. of ore = 100 lb.
θ = angle of repose = 38 deg.
h = height of ore column = 16.5 and 5.7 ft.

$$N = 1/2\times100\times16.5^2 \left(\frac{1-\sin 38^\circ}{1+\sin 38^\circ}\right) = 3{,}240 \text{ lb.}$$

$$N_2 = 1/2\times100\times5.7^2 \left(\frac{1-\sin 38^\circ}{1+\sin 38^\circ}\right) = 391 \text{ lb.}$$

[1] Ketchum, M. S.: "The Design of Mine Structures," p. 260. The McGraw-Hill Book Co., Inc., New York.

The line of action of N is prolonged until it intersects the bottom at x. The point x is then on a line through the center of gravity of the triangle EBC. Using a scale of 1 in. = 3,000 lb., the weight W of EBC is laid off as shown.

$W = BC/2 \times EB \times 100 = 16.5/2 \times 18.3 \times 100 = 15{,}000$ lb.

Combining N and W the resultant E is obtained. This force is resolved into two components, one normal to CD (the bin bottom) and the other parallel to CD. That normal to the bottom is $P_1 = 13{,}350$ lb. It is equal to the weight represented by triangle ECF. To find CF,

$$\text{Area } ECF = \frac{13{,}350}{100} = 133.5 \text{ sq.ft. and } EC = 24.62 \text{ ft.}$$

$$CF = \frac{133.5 \times 2}{24.62} = 10.85 \text{ ft.}$$

Trapezoid $DCFG$ represents the load on the bottom of the bin.

$CF = 10.85$ ft.; $= DG = 3.73$ ft.; and $DC = 16.16$ ft.

$$\text{Weight of } DCFG = DC \times \frac{CF+DG}{2} \times 100$$

$$= 16.16 \times \frac{10.85+3.73}{2} \times 100 = 11{,}800 \text{ lb.}$$

The 11,800 lb. is laid off on xz and resolved back to the vertical acting through x. This gives $P = 13{,}350$ lb. The force P is assumed as acting parallel to BC (front wall) through the center of gravity of $ABCD$ (the bin). Letting a = the distance the center of gravity is from AD; $d = a + b$ = width of bin; and h and h_1 the depth of the front and back walls respectively,

$$a = d/3\left(\frac{h+2h_1}{h+h_1}\right)$$

$$a = 12/3\left(\frac{16.5+2\times5.7}{16.5+5.7}\right) = 5.03 \text{ or } 5.0 \text{ ft.}$$

$$b = 12-5 = 7.0 \text{ ft.}$$

With the values of N, N_2, and P known, the reactions R, R_1, R_2, R_3, R_4, and R_5 may be found.

They are,

$$R = 1/3\ N_2$$
$$R_5 = 2/3\ N_2$$
$$R_1 = 1/3\ N$$
$$R_2 = 2/3\ N$$
$$R_3 = \frac{Pb}{a+b}$$
$$R_4 = \frac{Pa}{a+b}$$

To contain 100 tons the bin must have a length of 15 ft. Assuming the bin divided into three 5-ft. compartments, four posts, front and back, are required. The maximum load on any member will be distributed over an area 5 ft. wide ($2\frac{1}{2}$ ft. on each side of the central posts). The two end sections will have loads equal to one-half the inner ones. Regardless of this, all members will be the same size. Taking a 5-ft. width of ore, the foregoing reaction formulas must be multiplied by 5 ft. to obtain the total load for purposes of design.

$$R = 1/3 \times 391 \times 5 = -652 \text{ lb.}$$
$$R_5 = 2/3 \times 391 \times 5 = -1304 \text{ lb.}$$
$$R_1 = 1/3 \times 3240 \times 5 = -5400 \text{ lb.}$$
$$R_2 = 2/3 \times 3240 \times 5 = -10{,}800 \text{ lb.}$$
$$R_3 = \frac{13{,}350 \times 7 \times 5}{12} = +38{,}900 \text{ lb.}$$
$$R_4 = \frac{13{,}350 \times 5 \times 5}{12} = +27{,}800 \text{ lb.}$$

R, R_1, R_2, and R_5 require members to resist tension; R_3 and R_4 cause compression in the posts.

Selection of Members

Tension Members

To hold the structure together tension rods will be located at the points shown in Fig. 2. The stress at the top of the bin is 652+5400 = —6050 lb. At the bottom it is R_2 = —10,800 lb.

$$\frac{10{,}800}{16{,}000} = 0.675 \text{ sq.in., net area}$$

A $1\frac{1}{8}$-in. diameter rod has a net area of 0.693 sq.in. after threading. This size rod will be used for all tierods.

Posts

The posts are in compression, so their selection must be based on a column formula. The front posts above the sill carry only a compressive stress resulting from friction between the ore and the bin. Below the sills the stress is $R_3 = 38{,}900$ lb. The stress on the back posts above and below the sill is $R_4 = 27{,}800$ lb. The posts above the sill are selected on the basis of the stress in the back posts with an unsupported column length of 16.5 — 5.7 = 10.8 or 11.0 ft.

Trying a 6x8-in. timber,

$$\frac{P}{6\times8} = 1200 - 20\frac{11\times12}{6} = 760 \text{ lb. per sq.in.}$$

$$P = 6\times8\times760 = 36{,}480 \text{ lb.}$$

This is excessive. However, a 6x6-in. post is too small. The 6x8 provides 6x8 = 48 sq.in. for end bearing parallel to the grain. Perpendicular to the grain (that is, on the sill), the bearing area required is,

$$27{,}800 \div 300 = 93 \text{ sq.in.}$$

To provide this area a 10x10 or an 8x12 must be used, the choice depending on which details better with the rest of the bin. Later calculations indicate the 10x10. The short posts supporting the sills will be selected later.

Floor Beams

These members are subjected to bending. They are supported at the ends, and also near their middle, by a diagonal post set perpendicular to the beam. The beam is member DC and the diagonal post ky in Fig. 1*a*. The length of yC equals 8.9 ft. and yD equals 7.3 ft. The beam is assumed as acting like a continuous beam with three supports, carrying a distributed load increasing towards one end. Maximum bending moment and reactions may be closely approximated by the solution to follow. Fig. 1*b* shows a sketch of the beam.

Trapezoid $DCFG$ is split into,

$$yCFm = 8.9 \times \frac{7.0+10.9}{2} \times 100 \times 5 = 39{,}700 \text{ lb.}$$

and

$$DymG = 7.3 \times \frac{3.8+7.0}{2} \times 100 \times 5 = 19{,}500 \text{ lb.}$$

Average load per foot on yC = 39,700/8.9 = 4,460 lb.

Average load per foot on yD = 19,500/7.3 = 2,670 lb.

The bending moment on the beam is,

$$M_1 = M_3 = 0$$

$$M_2 = -1/8\left(\frac{wl^3+w_1l_1^3}{l^2+l_1}\right)$$

$$= -1/8\left(\frac{2670\times7.3^3+4460\times8.9^3}{7.3+8.9}\right) = -32{,}200 \text{ ft.-lb.}$$

The reactions,

$$R_1 = \frac{wl}{2} - 1/8\left(\frac{wl^3+w_1l_1^3}{l^2+ll_1}\right)$$

$$= \frac{19{,}500}{2} - 1/8\left(\frac{2{,}670\times7.3^3+4{,}460\times8.9^3}{7.3^2+7.3\times8.9}\right) = 5{,}330 \text{ lb.}$$

$$R_2 = 1/8ll_1\ (wl^3 + w_1l_1^3) + 1/2\ (w_1l_1+wl)$$

$$= \frac{1}{8\times7.3\times8.9}(2{,}670\times7.3^3+4{,}460\times8.9^3) + 1/2\ (4{,}460\times8.9+2{,}670\times7.3) = 37{,}630 \text{ lb.}$$

$$R_3 = \frac{w_1l_1}{2} - 1/8\left(\frac{wl^3+w_1l_1^3}{ll_1+l_1^2}\right)$$

$$= \frac{39{,}700}{2} - 1/8\left(\frac{2{,}670\times7.3^3+4{,}460\times8.9^3}{7.3^2\times8.9+8.9^2}\right) = 16{,}220 \text{ lb.}$$

The moment M_2 is the maximum negative bending moment. It occurs at the support R_2. Because of the nature of the loading, the maximum positive moment must be found. It occurs where the shear is zero. This happens twice, once between R_1 and R_2 and once between R_2 and R_3.

$R_1 - wx = 0$ and $x = R_1/w = 5{,}330/2{,}670 = 2$ ft. from the left end.

$M = R_1x - wx^2/2 = 5{,}330\times2 - 2{,}670\times2^2/2 = 5{,}320$ ft.-lb.

And from the right end.

$R_3 - w_1x_1 = 0$ and $x_1 = R_3/w_1 = 16{,}220/4{,}460 = 3.64$ ft.

$M = R_3x_1 - w_1x_1^2/2 = 16{,}220\times3.64 - 4{,}460\times3.64^2/2 = 29{,}300$ ft.-lb.

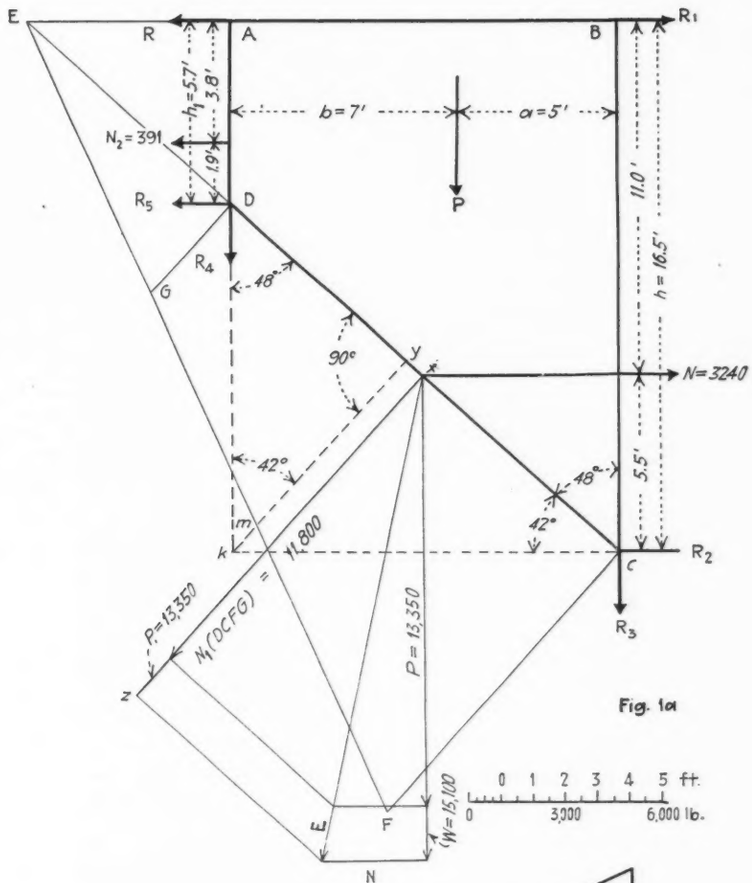


Fig. 1a

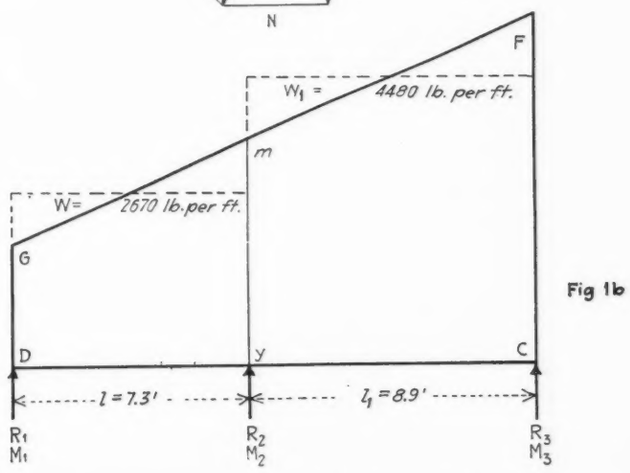


Fig 1b

FIG. 1a. . . . BIN STRESSES may be determined graphically and analytically by the method indicated here. Fig. 1b. . . . FLOOR BEAMS are supported at their ends, and also near their middle, by a diagonal post set perpendicular to the beam. Here is a diagram of the beam DC in Fig. 1a.

Neither positive moment exceeds the maximum negative moment. If they had, the selection of the beam would have been based on the larger.

32,200 ft.-lb. = 32,200×12 = 386,000 in.-lb.

From $M = 1/6\ sbd^2$,
where,

s = allowable working stress in bending = 1,400 lb. per sq.in.

b = breadth of beam, in.

d = depth of beam, in.

the size of the floor beam is found.

Trying a 10x14-in. timber,

$$M = \frac{1{,}400 \times 10 \times 14^2}{6} = 457{,}000 \text{ in.-lb.}$$

This is more than satisfactory. A 12x12 gives 403,000 in.-lb. It will not detail with the 10x10 posts; also it has a litt'e more timber in it than does the 10x14, which eaules a slight increase in co.t.

Diagonal Post

The stress in this member is R_3 = 37,630 lb. It is approximately 8 ft. long. One dimension will be 10 in. to detail with the floor beam. Because of its length it can be considered as a short post instead of a column.

37,630 ÷ 900 = 42 sq.in. for compression

For grain bearing on the floor beam there is required 37,630 ÷ 300 = 125 sq.in.

125 ÷ 10 = 12.5 in. depth of the post.
A 10x14-in. post must be used.

Because this post, at its lower end, must be cut across the grain, it should be examined for diagonal grain bearing. Also, the bearing area on the sill must be checked. The angle R_2 (diagonal post) makes with the sill is 48 deg. The angle of the grain in the diagonal post with the grain in the sill equals 90° — 48° =42° = θ.

$$N = \frac{PQ}{P \sin^2 \theta + Q \cos^2 \theta}^2$$

where,

N = allowable unit stress on inclined grain surface, lb. per sq.in.

P = allowable unit stress parallel to grain, lb. per sq.in.

Q = allowable unit stress perpendicular to grain, lb. per sq.in.

$$N = \frac{1{,}200 \times 1{,}300}{1{,}200 \times \sin^2 42° + 300 \cos^2 42°} = 512$$

lb. per sq.in.

The face has an area of $10 \times \frac{14}{\cos 42°}$ = 189 sq.in.
37,630 ÷ 512 = 74 sq.in. required for post face.

The force acting perpendicular to the sill

= 37,630 × sin 48° = 27,900 lb.
27,900 ÷ 300 = 93 sq.in. required for sill.

The diagonal post selected, after framing, provides sufficient area for sill and diagonal fiber bearing.

Bolts for Holding Diagonal Post to Sill

The stress in the bolts (taken perpendicular to the diagonal post) is,
37,630 ÷ tan 48° = 33,900 lb.
33,900 ÷ 16,000 = 2.12 sq.in. net area needed.

Using two bolts, each must have a net area of 2.21/2 = 1.06 sq.in. Two $1\frac{3}{8}$-in. bolts are required.

Bolts for Connecting Floor Beams to Sill

R_3 = 16,220 lb.

[2] Wood Handbook, p. 57. Forest Prod. Lab., U. S. Dept. of Agr., Sept. 1935.

16,220÷16,000=1.01 sq.in. One $1\frac{3}{8}$-in. bolt is necessary.

Flooring

The maximum load on the floor will be at the front of the bin. Taking a column of ore 16.5 ft. high, the load per square foot is,

16.5 × 1 × 100 = 1,650 lb. acting vertically.

Normal to the floor this becomes, 1,650 × sin 48° = 1220 lb.

With 5 ft. between beams, and assuming the load as being uniformly distributed on a simple beam, the bending moment is given by

$M = 1/8\ wl^2 = 1/8 \times 1{,}220 \times 5^2 \times 12 = 45{,}800$ in.-lb.

Trying a 4 × 12-in. plank,

$$M = \frac{1{,}400 \times 12 \times 4^2}{6} = 44{,}800 \text{ in.-lb.}$$

The bottom, sides, and ends will be made of 4x12 planking.

Sills

The center line of the diagonal post will be offset from the inner edge of the back post by 18.9/2 = 9.45, or 9.5 in. To this must be added 5 in. to obtain the distance from the center of the 10 × 10 bottom back post. The force acting here equals 27,900 lb. On the other end of the sill the floor beam has a reaction of 16,220 lb. The vertical component is 16,220 × sin 48° = 12,000 lb. The diagonal face of the beam is 10 × 12 in. As found later the front posts below the sill are 10 × 14 in. The center line of the beam intersects the top of the sill at 21 × ½ + 14 × ½ = 17.5 in. from the center of the lower post. The distance between the reactions (center of posts) equals 12′ + 10″/2 + 14″/2 = 13 ft. (These values are not absolutely correct. Exact values can be found only after assembling the data in the form of a sketch. The procedure followed is close enough.) With these data the maximum reaction is found to be at the rear end of the sill and has a value of 26,700 lb. The maximum moment is at the force resulting from the diagonal post.

$M = 26{,}700 \times 14.5 = 388{,}000$ in.-lb.

$M = 1/6\ sbd^2$

and $d = \sqrt{\dfrac{6M}{sb}}$ in.

To detail with the posts and beam, b must be 10 in.

$$d = \sqrt{\frac{6 \times 388{,}000}{1{,}400 \times 10}} = 13 \text{ in.}$$

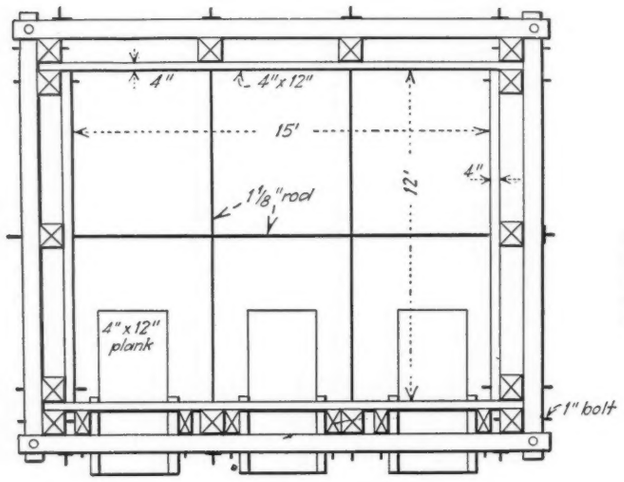
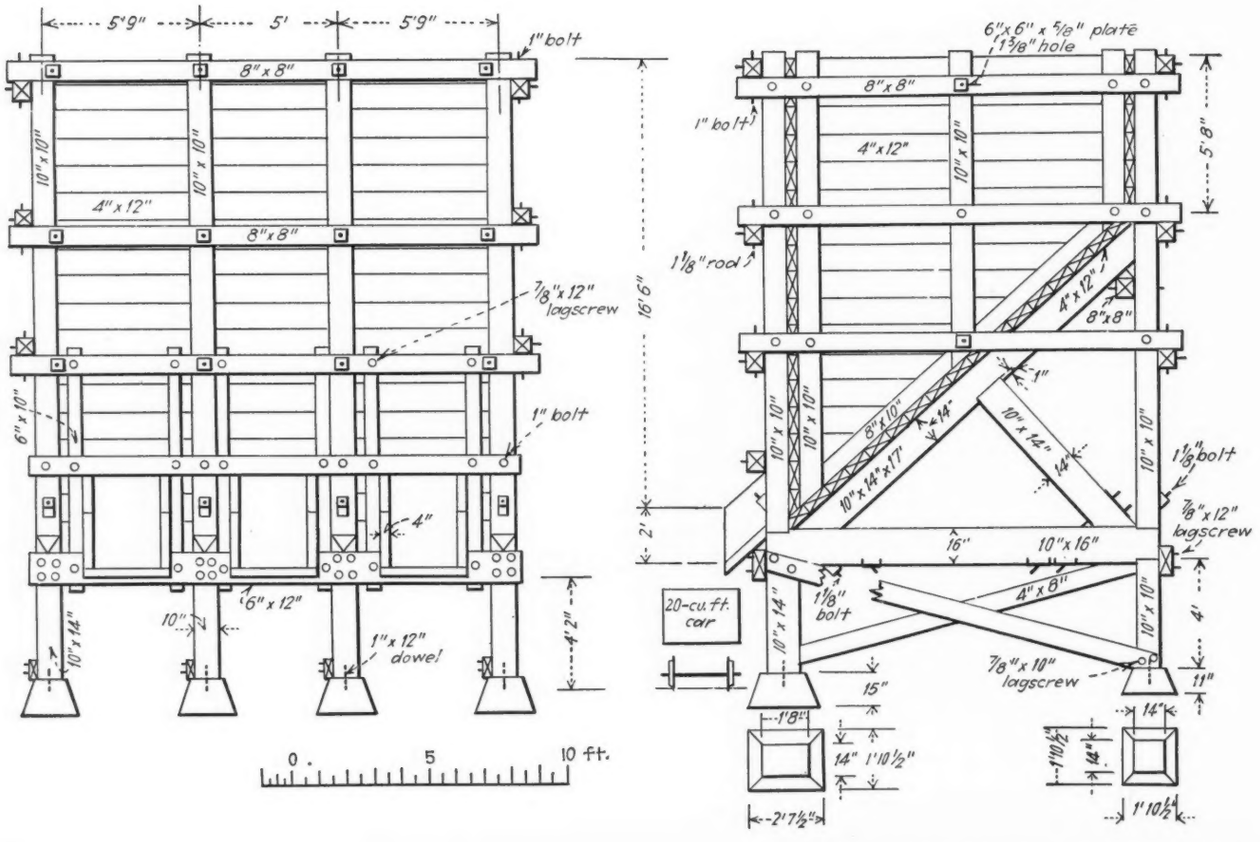


Fig. 2. . . . Tension rods located at the points indicated here serve to hold the structure of the bin together



Allowing a 1-in. dap, top, and bottom of sill,

$$13 + 2 \times 1 = 15 \text{ in.}$$

For the sills a 10 × 16-in. timber must be used.

Checking for shear at the edge of the back post (load = 26,700 lb.),

$$\frac{26{,}700}{10 \times 300} = 9 \text{ in. depth.}$$

The sill has a net depth of 14 in., so it is all right.

Washers (Bearing Plates) for Bolts and Tierods

1⅜-in. Bolts

The area necessary for one bolt is, 33,900/2 = 16,950 lb. per bolt.

The diameter of the hole in the plate is ¼-in. larger than the bolt. 1⅜ + ¼ = 1⅝ in.

Area of hole = 2.1 sq.in.

16,950 ÷ 300 = 57 sq.in. net area for bearing.

57 + 2.1 = 59.1 sq.in. area of plate.

A plate 7¾ × 7¾ in. has an area of 60 sq.in.

The thickness of the plate is found from[3],

$$M = \frac{Wy^2}{2(2y+a)} \text{ in.-lb.}$$

$$t = \sqrt{\frac{6M}{sb}} \text{ in.}$$

where,

M = bending moment on plate, in.-lb.
y = one-half greater dimension of plate after deducting diameter of hole, in.
a = diameter of hole, in.
s = allowable fiber stress in plate, lb. per sq.in. = 20,000 lb. per sq.in.
b = smaller diameter of plate after deducting hole, in.

a = 1 3/8+1/4 = 1 5/8 in.
y = (7.75−1.625)×1/2=3.1 in.
b = 7.75−1.625=6.12 in.
W = 16,950 lb.

$$M = \frac{16{,}950 \times 3.1^2}{2(2 \times 3.1 + 1.6)} = 10{,}570 \text{ in.-lb.}$$

$$t = \sqrt{\frac{6 \times 10{,}570}{20{,}000 \times 6.12}} = 0.72 \text{ in. or } 3/4 \text{ in.}$$

A plate 15½x7¾x¾ in. with a hole for each bolt is suitable.

Lower End of 1⅜-in. Bolt

The vertical component = 16,950 x cos 42° = 12,550 lb.

Horizontal component = 16,950 x sin 42° = 11,360 lb.

Two plates, with lugs on the ends to resist the horizontal force, 6½x 6½ × ⅝ in. are needed. The lugs are 1 in. deep in the clear.

[3] Staley, W. W.: Mine Plant Design. p. 69. The McGraw-Hill Book Co., Inc. New York.

The plates for the bolt connecting the floor beam to the sill are found in a similar manner. The top plate is 7¾ × 7¾ × ¾ in. The bottom plate is 6½ × 6½ × ⅝ in. with 1-in. lugs to prevent horizontal movement.

Tierods

For the tierods 6 × 6 × ⅝-in. plates with 1⅜-in. holes are satisfactory.

Lower Posts

The load on the front posts below the sill is R_3 = 38,900 lb. As the sill is 10 in. wide, one dimension must be 10 in.

Acting as short posts, 38,900 ÷ 900 = 43 sq.in. are required.

For bearing against the sill, 38,900 ÷ 300 = 130 sq.in. are needed.

130/10 = 13 sq.in.

The front posts will be 10 × 14 in.

The back posts

$$= \frac{27{,}800}{300 \times 10} = 9 \text{ in.}$$

The back posts below the sill will be 10 × 10 in.

Remaining Timber

The bracing on the sides, ends, and lower posts does not have any definite stress. It is required to "tie" the structure together. Such material will be made of 8 × 8-in. timber except as shown in Fig. 2.

Other Bolts

All other bolts will be 1 in. in diameter with standard washers except as shown in Fig. 2.

Footings

When convenient to do so, concrete footings will prove more satisfactory and durable than wooden sills for supporting the bin. A safe concrete mix for this purpose is 1 : 2 : 4. A concrete of this mix will safely stand a compressive stress of 400 lb. per sq.in. This is low, but because of the exposed condition, possible use of poor aggregate and sand, it should be used. The loads on the footings are taken equivalent to R_3 = 38,900 lb. and R_4 = 27,800 lb. The bearing on the soil will be taken at 8,000 lb. per sq.ft. Actually it depends on the nature of the ground (sand, soil, rock, or other material). The value assumed is for compact sand.

Front Posts

Area for post bearing = 38,900 ÷ 400 = 97 sq.in.

The front post provides 140 sq.in. No base plate is needed to distribute the load.

The area of the top of the footing should be at least twice the area of the column or base plate[4].

$$\text{Area of top} = \frac{2 \times 10 \times 14}{144} = 1.94 \text{ sq.ft.}$$

Proportioning this to the 10 × 14 post, the top is 1.65 × 1.18 ft. or 1 ft. 8 in. by 1 ft. 2 in.

Area of bottom = 38,900 ÷ 8,000 = 4.86 sq.ft.

Proportioning to the top, the bottom is

2.61 by 1.87 ft. or 2 ft. 7½ in. by 1 ft. 10½ in.

The depth[5] is found from

$$d = \frac{(b-a)}{2} \tan 60°$$

where,

b = larger dimension of bottom of footing, feet.
a = larger dimension of column base, feet.

$$d = \frac{(2.61-14/12)}{2} \times \tan 60° = 1.25 \text{ ft.} = 1 \text{ ft., } 3 \text{ in.}$$

Back Posts

Top: 1 ft. by 1 ft. 2 in.

Bottom: 1 ft. 10½ in. by 1 ft. 10½ in.

Depth: 11 in.

Sand, Gravel, and Cement

$$\text{Cement} = \frac{11}{1+2+4} = 11/7 = 1.57 \text{ bbl. per cu.yd. of concrete.}$$

Sand = 1.57×2×3.8/27 = 0.44 cu.yd. of concrete.

Gravel = 1.57×4×3.8/27 = 0.88 cu.yd of concrete.

Volume of Footings

Front Post.

$$V = 1.25/3\,(1.94+4.86+\sqrt{1.94 \times 4.86})$$
$$= 3.3 \text{ cu.ft.}$$
$$= 0.122 \text{ cy.yd.}$$

Volume of four footings = 4 × 0.122 = 0.488 cu.yd.

Volume of four back post footings = 0.316 cu.yd.

Total = 0.488 + 0.316 = 0.804 cu.yd. of concrete.

To supply this,

1.57 × 0.804 = 1.21 bbl. or five sacks of cement.

0.44 × 0.804 = 0.35 cu.yd. sand.

0.88 × 0.804 = 0.71 cu.yd. gravel.

The posts will be held to the footings by a 1-in. diameter iron rod. extending 6 in. into both post and footing.

The bin as designed contains 10,500 board feet of lumber (this includes a 10 per cent allowance for waste in framing) and 1,850 lb. of bolts, tierods, washers, and similar supplies.

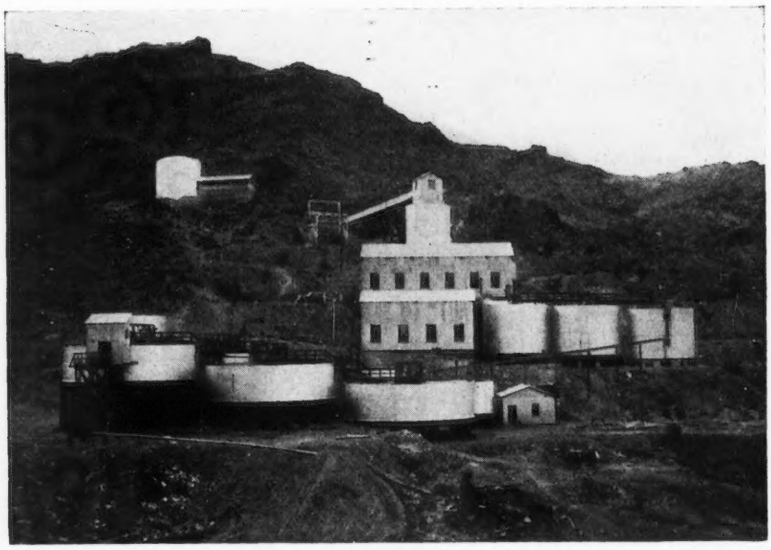
[4] Staley, W. W.; *Op. cit.*, p. 63.
[5] Staley, W. W.: *Op. cit.*, p. 63.

Gold Road Cyanide Plant

Modern and Efficient

United States Smelting Company's 300-ton mill, near Oatman, Ariz., has all equipment interlocked electrically. . . Layout compact; parts accessible

John B. Huttl
Assistant Editor



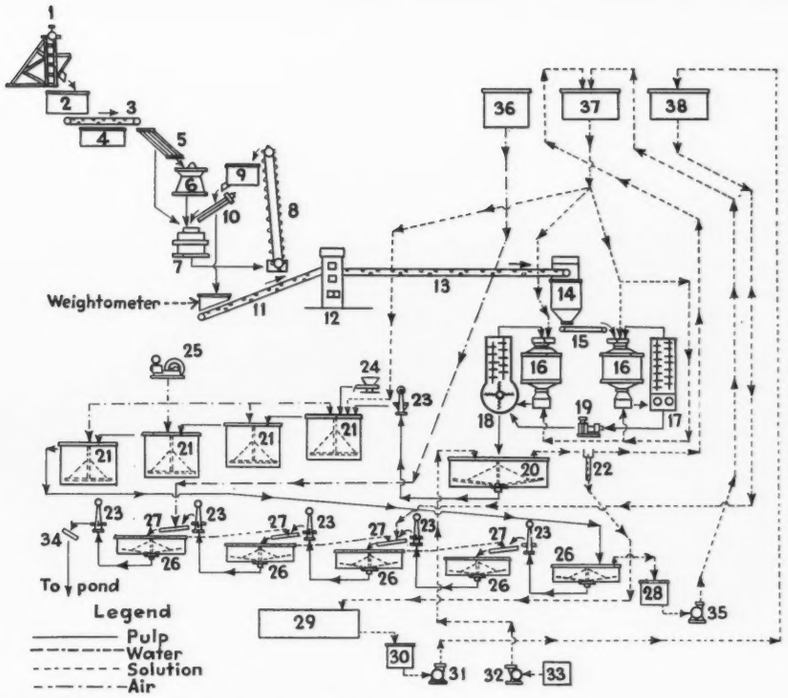
THE NEW CYANIDE PLANT is about 900 ft. from No. I shaft, shown in the accompanying photograph. Save for the all-steel sampling plant, all buildings are of timber on concrete foundations.

HEADFRAME of No. I shaft, also the crushing plant and the sampling plant, at the Gold Road mill

ASSERTION that profitable operation of any industrial enterprise involves methods adapted to conditions is particularly true in regard to gold mining, and for the following pertinent reasons: (1) Gold is purchased by the governments of the world at a fixed price, and (2) because of this fact the industry is non-competitive and as a consequence is deprived of the privilege enjoyed by others periodically to adjust the price of its product in accordance with prevailing economic conditions. In other words, higher manufacturing costs brought about chiefly by increased wages and higher prices for supplies during inflationary periods cannot be passed on to the consumer but must be met by lower operating costs. To attain this objective, the operator contemplating development of a new mine or rehabilitation of an old mine must exercise great care in the selection of methods and equipment to be applied both in surface and underground operations. This task, obviously, is more difficult when a property of the marginal type is in question.

In this respect, the new 300-ton mill of the United States Smelting, Refining & Mining Company at Gold Road, in the Oatman district of Arizona, is noteworthy in that the most modern methods and equipment available have been incorporated in its design. The general layout of the machinery is compact, yet each unit is easily accessible if repairs become necessary and can be observed from any point desired in the interior of each building. Feeding and sampling of ore are automatic, and all machinery is electrically interlocked. However, before continuing the description of the design of the plant, a brief history of the Gold Road property and the work carried on there by the company during the past two years may be of interest.

The mine is situated just below Union Pass, about 26 miles southwest of Kingman, Ariz., and $1\frac{1}{2}$ miles from Oatman, Ariz., and can be reached over United States Highway 66, which passes through Gold Road. Railroad communication is established at Kingman and at Topock, whence supplies are trucked to the property. The first work done on the Gold Road vein was in 1900, when several individuals started small-scale exploitation of rich ore at shallow depths. Actual development of the mine commenced in 1902 after acquisition and consolidation of the different holdings by the Gold Road Mining & Exploration Company, organized that year. Mine production was treated in a 40-stamp mill employing the cyanide process and situated at the site now occupied by the new plant. The present company purchased the property in 1911. It was operated steadily



FLOWSHEET of Gold Road cyanide plant includes mechanical-air agitation, counter-current decantation, and disposal of tailings without filtration

LEGEND

1. Headframe
2. 300-ton concrete storage bin
3. 36-in. incline conveyor
4. Waste bin
5. 4x6-ft. steel grizzly, spaced 2 in.
6. No. 12 gyratory crusher
7. 3-ft. Symons cone crusher
8. Bucket elevator
9. Surge bin
10. 47x88-in. vibrating screen
11. 18-in incline conveyor
12. Sampling plant
13. 18-in. conveyor
14. 300-ton mill bin
15. Feeder
16. No. 76 Marcy Ball mills
17. Dorr Multizone classifier
18. Dorr bowl classifier
19. 6-in. Hydroseal sand pump
20. 45x12-ft. primary thickener
21. 30x22-ft. agitators
22. Solution splitter
23. No. 4 Duplex Dorr mud pumps
24. Cyanide feeder
25. 200-cu. ft. compressor
26. 45x12-ft. thickeners
27. Repulpers
28. 16x12-ft. storage tank
29. Merrill-Crowe precipitation plant
30. 16x12-ft. storage tank
31. 3-in. centrifugal pump
32. 2-in. centrifugal pump
33. 16x16-ft. floor sump
34. Sampler
35. Two 3-in. centrifugal pumps (One as a spare)
36. 24x20-ft. fresh-water tank
37. 30x10-ft. mill-solution tank
38. 30x10-ft. barren-solution tank

until 1916, and again during 1922 and 1923. Since then and up to 1934 only intermittent operations by leasers were carried on.

The mine is developed by two vertical shafts 865 ft. and 1,135 ft. deep respectively, known as No. 1 and No. 3, and the Line Road tunnel, which is more than 3,000 ft. long. Production is hoisted through No. 1 shaft, the manway of which was recently enlarged to accommodate a 1-ton skip used as counterbalance. Grouped around this shaft are the hoist house, containing a double-drum hoist and compressor equipment; a combination repair and drill sharpening shop; the new crushing plant, and the mine office.

The bulk of the ore treated currently at the mill is mined underground, though small quantities of ore are obtained from surface operations and shallow workings above the Line Road tunnel which are trucked to the crushing plant. Blocked-out ore is mined either by open-stope (underhand) or shrinkage stoping methods, the character and size of the orebody determining the method to be applied. Underground haulage is completely electrified. The broken ore, stored in pockets on the 700 level, is loaded into 1-ton end-dump cars, which are hauled in trains by storage-battery locomotives to the loading pocket in the shaft. The ground is relatively firm; hence timber consumption is not large.

The new mill, placed in operation on Feb. 1, 1937, is about 900 ft. from No. 1 shaft and consists of three separate units—namely, a crushing plant, a sampling plant, and the mill proper, all joined together by 18-in. belt conveyors. Save for the sampling plant, which is of all-steel construction, all buildings are of timber on concrete foundations. As mentioned previously, the different plant machinery is electrically interlocked—that is, the control is so arranged that the motors will start one after another, in any order or sequence desired, and a generous number of trolley cranes are available throughout the plant to facilitate repairs. No efforts have been spared to make operations efficient and safe.

The capacity of the crushing plant with its dust-collecting system is about 38 tons per hour. As indicated in the accompanying flowsheet, two-stage crushing is practiced. The mine-run ore is hoisted in 1½-ton skips and dumped into a 300-ton concrete storage bin just below the headframe, whence it is drawn by a vibrating feeder and fed onto a 36-in. incline belt conveyor discharging over a 4x6-ft. steel grizzly with 2-in. openings. This belt conveyor is powered by a 3-hp. motor and moves at a speed of 60 ft. per minute. Crushing to minus 1½ in. is done in a No. 12 gyratory crusher driven by a 50-hp. motor. This is followed by secondary crushing in a 3-ft. Symons cone crusher fitted with a special head and driven by a 75-hp. motor, which receives both the grizzly undersize and the primary crusher product and operates in closed circuit with a 47x88-in. vibrating screen with ⅜-in. openings. The screen is gravity fed from a surge bin served by a bucket elevator.

Screen undersize is transported to the sampling plant via an 18-in. belt conveyor installed on a slope of 2½ in. per foot, and measuring 200 ft. from center to center. The layout of the sampling plant and equipment used follow standard design, and the sampling method employed is to take a 10 per cent cut of the ore delivered. Three mechanical cutters, two sets of rolls, one 10x6 in. and the other 6x4 in. in size, and a bucket elevator are available for this work. Ore leaving the sampling plant is delivered to the 300-ton mill bin over an 18-in. belt conveyor measuring 630 ft. between centers and operating at a speed of 250 ft. per minute. The bin is circular in shape, with a hopper bottom, and is made from steel plates. Ore is withdrawn and conveyed to the grinding section of the mill by a mechanical feeder. At this point lime is also added to the ¼-in. ball-mill feed by means of an automatic feeder.

Because of the fineness of the gold, which is widely distributed through a gangue of quartz and some calcite, and the fact that no great quantity of sulphides exists, a high degree of grinding is required and the all-sliming process is followed. Grinding to about 85 per cent minus-200 mesh, as at the crushing plant, is done in two stages, with two No. 76 Marcy ball mills available on the grinding floor. The primary unit operates in closed circuit with a Dorr Multizone classifier. Overflow from this classifier is pumped by a 6-in. Hydroseal sand pump to the feed box of a Dorr bowl classifier in closed circuit with the secondary grinding unit. Both mills are driven by 200-hp. motors, and two 5-hp. motors furnish power for the classifiers. Dimensions of the classifiers are as follows: The bowl, 12 ft. 1 in. by 26 ft. 8 in. by 14 ft., and the Multizone, 6 ft. by 23 ft. 4 in. The overflow from the bowl classifier flows by gravity direct to the 45x12-ft. Dorr primary thickener. Settling

area of this thickener, on a basis of 300 tons of dry ore per day, is about 5.3 sq.ft. per ton. Power required to drive the rake mechanism is 1½ hp.

The solution overflow is laundered in a 4-in. pipe to a solution splitter, whence about 150 g.p.m. are directed to the Merrill-Crowe precipitation plant, and 50 g.p.m. to the mill solution tank. Underflow is pumped by a No. 4 duplex Dorr mud pump driven by a 5-hp. motor to No. 1 agitator. From here the pulp flows by gravity to No. 2, to No. 3, and thence to No. 4 agitator, sufficient mill solution being added at No. 1 agitator to raise the dilutions to 2:1. The four units are 30x22-ft. Dorr machines. Air for agitation is supplied by a 200-cu.ft. compressor powered by a 20-hp. motor, and a mechanical cyanide feeder is available at No. 1 agitator.

The overflow from No. 4 agitator goes to the feed well of the first of five 45x12-ft. Dorr thickeners, each driven by a 1½-hp. motor. Underflow from this unit at 1:1 dilution is pumped by a No. 4 duplex Dorr mud pump to a launder feeding a simplex Dorr repulper discharging into the feed well of No. 2 thickener. The overflow discharges into a 6x12-ft. storage or sump tank, from which it is pumped to the 30x10-ft. mill solution tank by two 3-in. centrifugal pumps (one as a spare).

Underflow from No. 2 thickener is pumped by another No. 4 duplex Dorr mud pump to the launder feeding a second Dorr repulper discharging into the feed well of No. 3 thickener, while the overflow returns to the feed well of No. 2 thickener. This operation is repeated on two more occasions, as shown in the accompanying flowsheet. The underflow from No. 5 thickener, from which a sample is taken at set intervals by an automatic sampler, flows by gravity to the tailings pond in the canyon below the cyanide plant. Mill solution is added to No. 3 repulper, fresh water to No. 5 repulper.

Pregnant solution or the overflow from the primary thickener is precipitated in a Merrill-Crowe plant of the simultaneous clarification-precipitation type capable of handling 900 tons of solution a day, the precipitate being sent to the refinery. Barren solution collected in a 16x12-ft. sump tank is pumped by a 2-in. centrifugal pump to the 30x10-ft. storage tank mentioned previously, and material in the 16x16-ft. floor sump is returned to the primary thickener by a second 2-in. centrifugal pump.

Tankage for thickening, agitating, and storage of solution and water is open. All tanks are of steel and painted on the outside with aluminum paint. The wood trestles supporting the tanks and the conveyors between the crushing, sampling, and cyanide plants are covered with black paint.

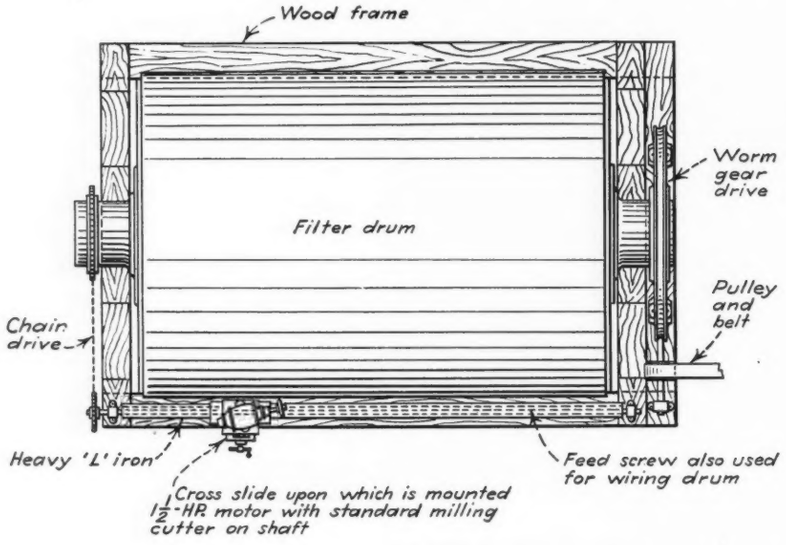
Operations at Gold Road are directed by L. H. Duriez, superintendent, with Paris Brough in charge of the mill. F. C. Torgelson was engineer in charge during construction of the mill, which was designed by the company's engineering department.

▼ ▼ ▼

Reconditioning the Surface of a Filter Drum

A PREREQUISITE to efficient filtering and low maintenance costs is a smooth and true filter-drum surface. On the newer type filter of all-steel construction, maintenance of a proper drum surface is a relatively easy task, but at mining properties where large units with wood covering are in use, difficulties often arise when the eroded surface must be reconditioned in order that filtering efficiency and maximum service of the canvass covering may be obtained. This operation can be carried out in different ways, either by hand, which is both time-consuming and costly, or by some mechanical arrangement. The method explained in the accompanying sketch has been found highly satisfactory at the cyanide plant of Empire Star Mines Company, Ltd., at Grass Valley, Calif.

As may be noted, the set-up is simple, and the different auxiliaries were made from scrap material. The trunnions of the drum proper rest in plain bearings at each end of the sturdy wooden frame, and reconditioning of the drum surface is done with a standard milling cutter attached to the shaft of a 1½-hp. motor mounted on a homemade cross-slide. Motive power is transmitted by a worm-gear drive on one trunnion, and the lead screw is actuated by a simple chain drive on the opposite trunnion. The way upon which operates the saddle with the cross-slide is made from a piece of heavy "L" iron shown in the line cut.


Wood frame
Worm gear drive
Filter drum
Pulley and belt
Chain drive
Heavy 'L' iron
Feed screw also used for wiring drum
Cross slide upon which is mounted 1½-HR motor with standard milling cutter on shaft

▼ ▼ ▼

Hydraulic Mining Looks Up in California

(*Continued from page* 33)

under 300-ft. head to move 135,000 cu.yd. in a seven-month season. Transportation facilities are good and operating costs are reasonable.

Opportunities are favorable in the Klamath region, as it has not received the attention that has been bestowed on the districts in the Sierra Nevada. It is not to be expected that it will ever attain the production of the latter, because the gold is not there, but there is reason to believe that it will contribute substantially for many years.

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[9] Report of the Klamath-Trinity River Fact Finding Committee California State Chamber of Commerce. 1936.

Canada Aids Its Mining Industry

A glimpse of the Dominion's ore-dressing and metallurgical laboratories

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ESTABLISHED in 1910 to make a worth-while contribution to the welfare of the mining industry of Canada, the ore-dressing and metallurgical laboratories of the Metallic Minerals Division of the Dominion Bureau of Mines, at Ottawa, provide various facilities to this end. These comprise ore-testing laboratories, including a chemical research laboratory and a well-equipped mineragraphic laboratory; pyrometallurgical laboratories, including metallographic, mechanical testing, and heat-treating laboratories; and general chemical laboratories.

The function of these laboratories is to assist the prospector, the mining company, or others interested in the industry, by carrying out investigations on metallic ores and mineral products submitted for examination and test. Methods of treatment are determined and recommended and outline flowsheets proved which take into consideration as far as possible the local conditions existing at the property. In addition, the laboratories are called upon to investigate problems from other Government departments.

Laboratory facilities may be made available to those connected with the industry who may wish to work out problems in cooperation with the division staff. This is of particular interest to consulting engineers retained by mining companies. Such companies are encouraged to send their own engineers to assist. Ores are not accepted for customs treatment.

Departmental regulations governing shipments for testing prescribe that samples submitted should be representative of the grade and character of ore or materials to be treated and that, according to the tests desired, their size should fall within the following ranges:

ORE-TESTING LABORATORIES of the Dominion Bureau of Mines at Ottawa are housed here. In the larger building are the main offices and the analytical and small-scale testing laboratories. The heavier units are in a small building at the rear

1. Ores and minerals: (a) For examination and identification of the mineral constituents only—from a few pounds up to 100 lb. (b) For examination and preliminary tests—100 lb. to 1,000 lb. (c) For examination, preliminary tests and for small-scale continuous tests—1 ton to 2 tons. (d) For large-scale continuous tests on tonnage check basis—5 tons to carload lots.

2. Concentrates and other mill and metallurgical products: For examination and experimental tests—from a few pounds to 100 lb. and upward.

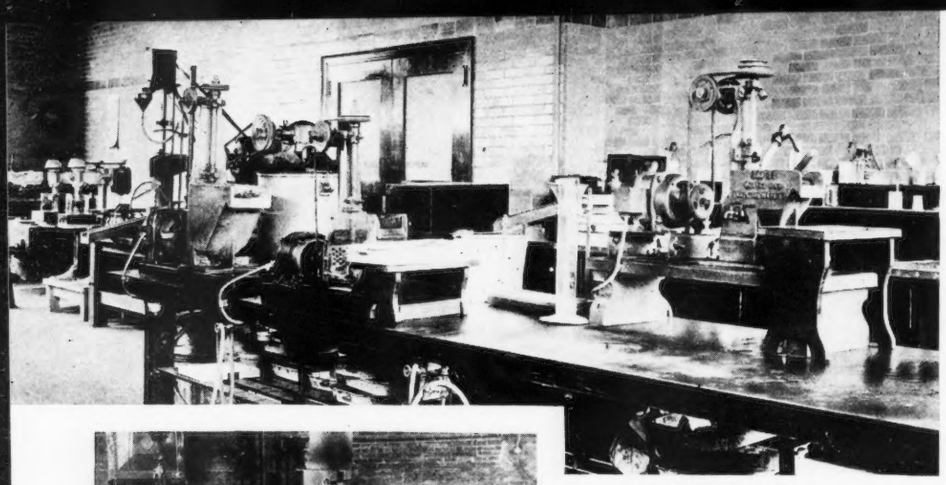
All transportation charges must be paid by the shipper. In addition, the shipper of bulk or tonnage samples intended for analysis only, must pay in advance a fee based on the size of the sample and on the elements determined. Upon completion of the work a report is submitted. Information regarding the results may not be used for advertising.

To operate and maintain the laboratories requires a staff of fifty men. Of these, half are engineers and clerical workers and the others are operators, mechanics, and laborers. The time allotted for a test varies according to the nature and importance of the deposit.

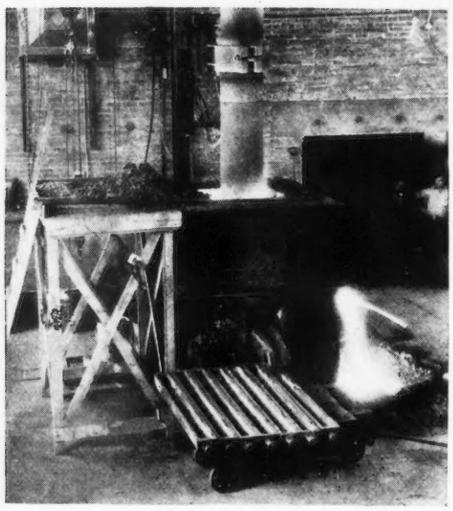
When a shipment of ore is received, it is sampled and assayed. This work is so carefully done that little trouble has occurred from accidental "salting." Typical specimens are sent to the modern mineragraphic laboratory for mounting, polishing, and microscopic examination, the report here obtained providing a comprehensive picture of the ore to guide the investigator.

By a series of small-scale tests, the broad outlines of the process best suited to any given ore can be determined and if warranted the details can then be worked out more thoroughly by continuous large-scale tests carried out in a mill equipped with semi-commercial-scale machinery under conditions approaching plant practice.

Two fully equipped laboratories are maintained for small-scale testing. Cyanidation tests are made in bottles which are agitated by a tumbling motion. In the light of our experience, extractions and reagent consumptions obtained in this way are more consistent with those secured in practice than those obtained by any other method of agitation. The laboratories are also equipped with an Infrasizer, a Haultain Super-panner, and small

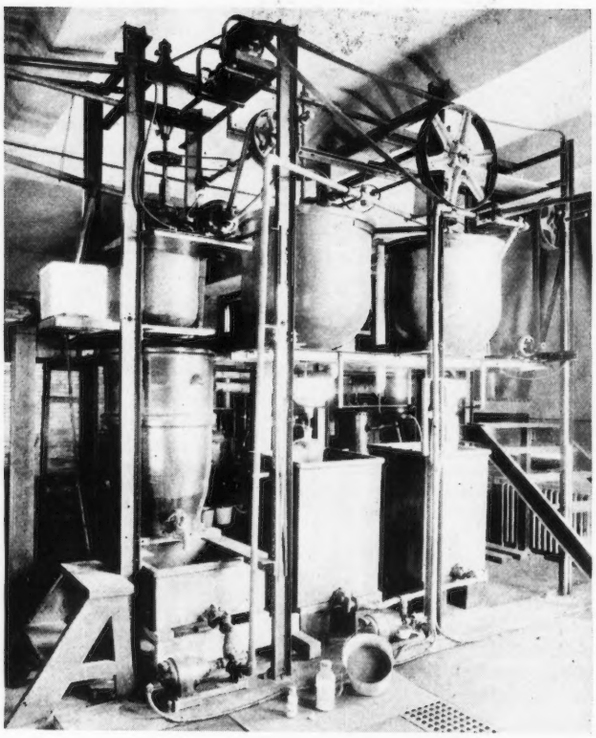


TWO LABORATORIES are maintained fully equipped for small-scale testing. Here is one of them (above), with flotation machines and cyanide agitator

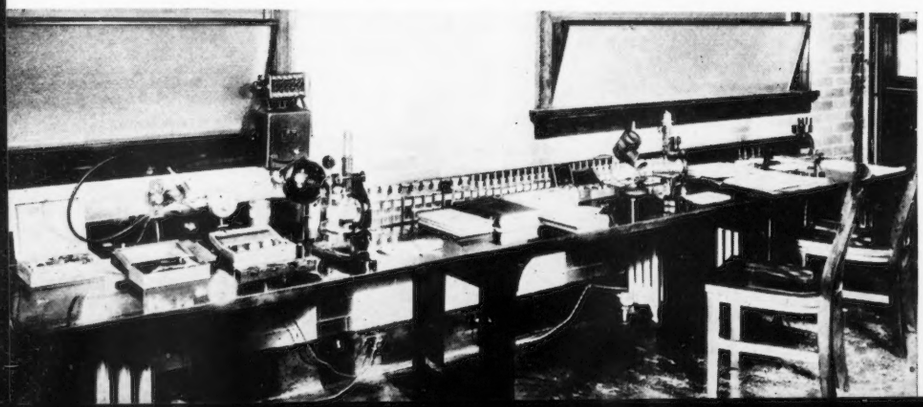


LEACHING TANKS of corrosion-proof construction in the chemical research laboratories. In the latter are studied special chemical problems that arise in operating mills, the extraction of metals from refractory ores, and new processes

ELECTRIC SMELTING FURNACE of the conducting hearth type, in the pyrometallurgical laboratory. At the right, slag is being tapped on the right-hand side of the furnace



IN THE MINERAGRAPHIC LABORATORY. Here mineral sections are mounted, polished, and examined microscopically, the report giving a picture of the ore that serves to guide the investigator



roasting furnaces, to aid in the solution of problems arising from refractory ores and to explain tailings losses in the course of routine testing.

The large-scale units are so arranged as to allow a maximum of flexibility in arranging different flowsheets for the varied ores submitted and can handle any quantity from 1 ton upward.

The primary grinding mills are connected by a bucket elevator to either of two classifiers located at the highest point in the building, and the classified product flows by gravity to flotation machines, concentrating tables, jigs, or magnetic concentrators, as desired. A smaller ball mill in circuit with a third classifier can be used as a regrind mill for the large-scale unit, or may serve as the primary grinding mill for tests on a smaller scale, taking 500 lb. per hour of $\frac{1}{4}$-in. feed.

Flotation equipment consists of three ten-cell batteries, which can be used individually or in series. Each battery is complete with conditioning tank and a reagent feeder that will feed small quantities of reagents accurately. The cells are No. 7 Denver Sub-A's, of about 1 cu.ft. capacity, each equipped with an individual motor and a three-speed pulley.

The laboratories have four tables, one full deck and three quarter decks; a set of two James jigs; and blanket strakes for gravity concentration tests, as well as a fairly complete range of magnetic separators, both wet and dry, the list including one each of the following: Davis tube concentrator, Dings high-intensity magnetic separator, Gröndal dry separator, Ullrich four-pole separator, Gröndal cobber, Gröndal two-drum separator, Davis log washer, Stearns high-duty separator, and a Roche wet magnetic separator.

The first three machines mentioned are used for small-scale tests and the others are standard-size machines for large-scale work. The Roche machine, a combination of both the rougher and finisher types, is the newest machine of this class in the laboratories and will handle 2.5 tons of feed per hour per foot of belt width and with as much as 40 per cent of magnetic iron in the feed it will recover 99.9 per cent of the iron in the finished product. Power consumption is, if necessary, slightly more than 0.75 hp. per ton of feed.

A small milling unit, complete with ball mill, classifier, and flotation machines, having a capacity of 100 to 150 lb. per hour, is also available for tests on 2- to 3-ton shipments. This unit is equipped with a Size "A" Hardinge Constant Weight feeder, set to feed between the limits of 60 and 180 lb. per hour. It has a battery of ten Denver Sub-A No. 5 flotation machines. Other accessories for almost any test run can be hooked up

with this unit, as also with the larger unit.

In the chemical research laboratories, special chemical problems developed in operating mills are investigated, the extraction of metals from refractory ores is studied, and new processes, methods, and ideas are tested. Problems having to do with metals of uncommon or rare occurrence are also here worked out, as, for example, the treatment of the radium-bearing ores from Great Bear Lake, toward which a valuable contribution resulted from the investigation. Production of electrolytic iron from pyrrhotite and pyrite ores and of iron and titanium white from ilmenite ore has also been investigated.

The pyrometallurgical laboratory, with which is associated the mechanical testing and metallographic laboratories, is furnished with the most modern equipment and is prepared to investigate problems having to do with iron, steel, and alloys.

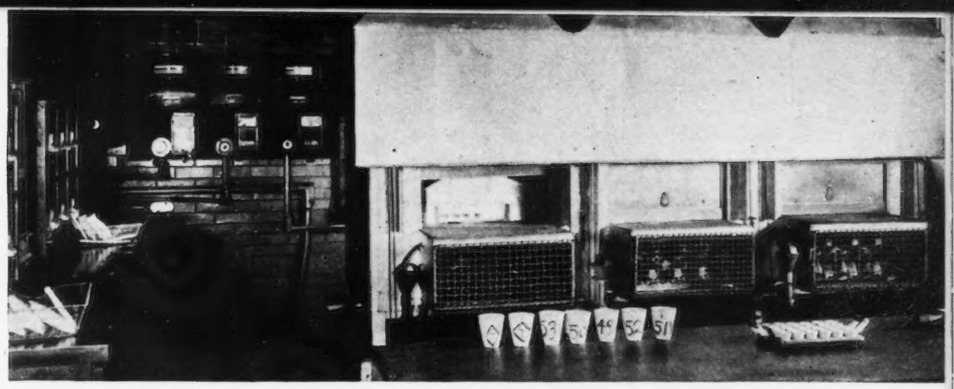
Direct reduction tests on iron ores are made in an electrically heated retort using coke or city gas as a reducer. Sponge iron produced is concentrated by a high-duty Stearns magnetic concentrator and compressed in briquets by a Southwark machine under 70 tons' pressure per square inch. The briquets are then melted and made into steel.

The mechanical testing laboratory is equipped for all kinds of tests, including fatigue, tensile, compression, impact, and hardness.

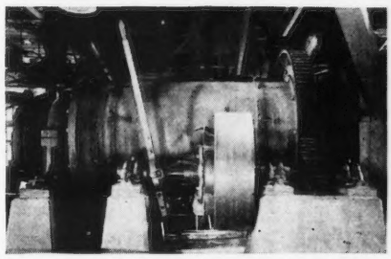
Equipment of the metallographic laboratory is adequate for investigating and photographing macrostructures and microstructures of metals and alloys.

Assaying and analyses of samples are done in the chemical laboratories. More than 16,000 determinations are made yearly on approximtaely 4,000 samples. The balance room is equipped with the latest types of precision balance and the fire-assay laboratory with three electric muffle furnaces of the Globar type. These furnaces were designed by the chief chemist and are equipped with automatic temperature control and time clocks for starting and stopping.

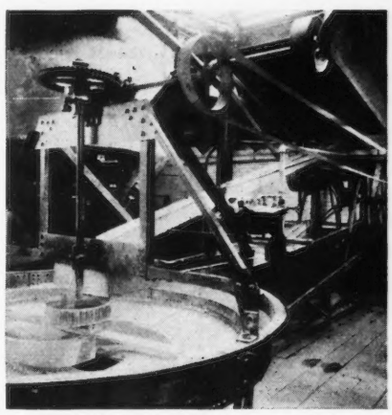
To date, approximately 1,000 investigations as to methods of treatment have been conducted on a great variety of ores and metallurgical products from all parts of Canada. In 1936, the number of such investigations was 128. During the recent expansion in gold mining, more than 50 new mills have been put in operation whose flowsheets are based on the results of investigations conducted in these laboratories. At the same time, much work is done for operating companies in the way of assisting them to reduce tailing losses and change flowsheets to meet changing ore conditions.



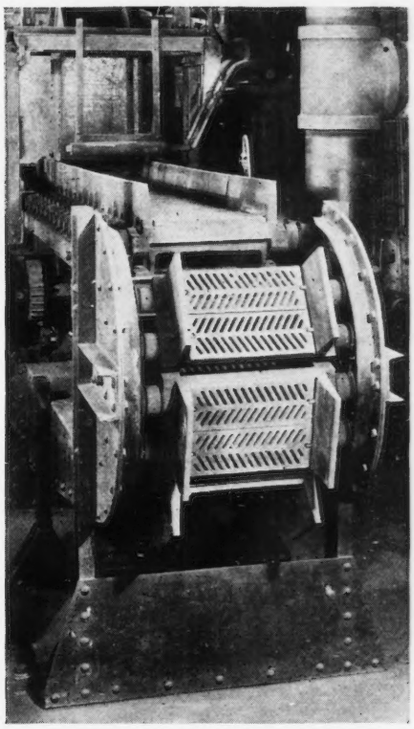
MUFFLE FURNACES of the electric Globar type, used in the fire assay laboratory. At the left are automatic control devices



A ROD MILL is also included in the equipment of the large-scale unit

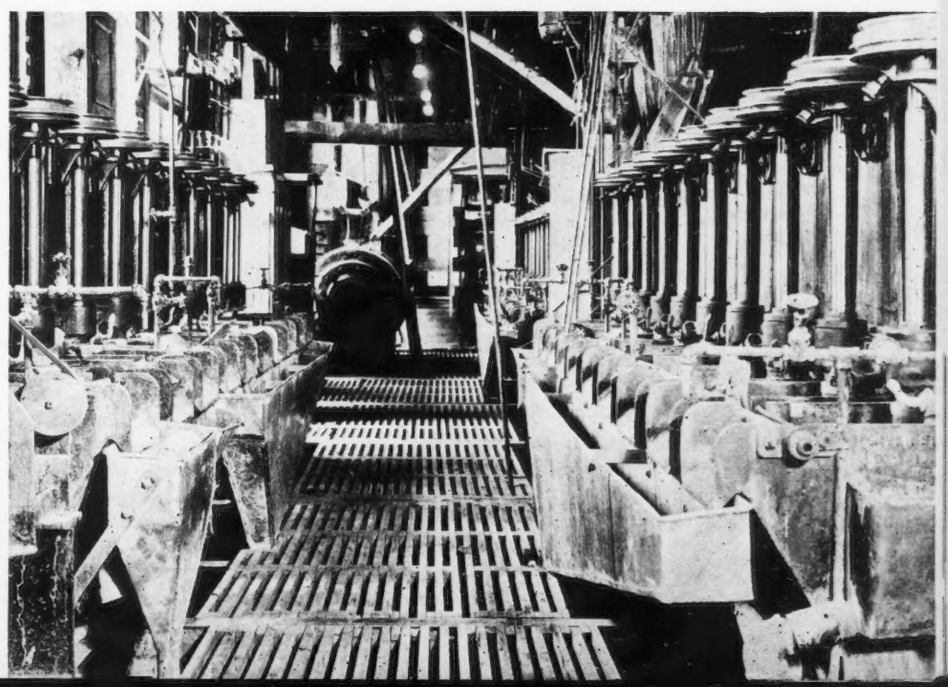


THIS BOWL CLASSIFIER (above) is part of the equipment of the large-scale mill. Units such as these are arranged to give maximum flexibility in arranging flowsheets



CONTINUOUS LARGE-SCALE TESTS may also be made in a mill equipped with semi-commercial-scale machinery. Here is a Dwight-Lloyd sintering machine

THREE FLOTATION MACHINES of ten cells each, in the mill (below). These can be used individually or in series. Each has its own conditioning tank and reagent feeder



American Mining Congress Acts on Industry's Problems

Editorial Staff Report

WITH a record-breaking attendance and the best exposition of metal mining equipment yet held, the Western Division of the American Mining Congress met in Salt Lake City, Utah, Sept. 7 to 10, 1937. The attendance reflected a high degree of interest in metal mining throughout the country, and the spirit of the convention was one of optimism despite some adverse political conditions. The deliberations of the Congress were embodied in a declaration of policy on social, economic, and political matters, a digest of which appears on the opposite page.

Mineral Land Policy

Combating the proposal of Secretary Ickes to withdraw mineral lands from entry and subject them to a leasing system, Erskine R. Myer, of Denver, reviewed the benefits of the present policy and scrutinized the new proposal. In 1866 Congress threw open to exploration and location the mineral lands of the United States, recognizing "the local customs and rules of miners in the several mining districts." Three important principles were established: "First, that all mineral lands of the public domain should be free and open to exploration and development. Second, that rights which had been acquired in these lands under a system of local rules with the apparent acquiescence of the Government should be recognized and confirmed. Third, that titles to at least certain classes of mineral deposits or lands containing them might be ultimately obtained. By the Act, the Government abandoned the idea of exacting royalties on the products of the mines and gave license to its citizens to search for precious and other minerals with some assurance of security in possession and right of enjoyment. Such has been, so far as metal mines are concerned, the national policy since that day."

After tracing the stimulating effect of mineral discoveries on the rapid development of the country, Mr. Myer examined the arguments for the leasing policy. He found them deficient in a full comprehension of the nature of prospecting, the slim chances of success, and the necessity for rewarding personal initiative in hazardous ventures. In conclusion he questioned, as a matter of public policy, the wisdom of changing a system which "for 70 years has proved sound and productive."

Stream Pollution

Recognizing the desirability of preventing the pollution of streams with industrial wastes, Robert M. Searles, of San Francisco, nevertheless argued against the passage by Congress of the stringent and unreasonable Lonergan bills, S. 3958 and 3959. These bills provide for nation-wide Federal control of stream pollution, with authority to promulgate orders and rules. As a counter proposal, Mr. Searles laid down a constructive program for industry to meet a situation which, admittedly, is growing more and more acute.

"In the first place, industry must not hide its head in the sand," said Mr. Searles. "Unless cooperation is given to the extent that it can reasonably be given, the excuse for regulation will exist, and in my opinion regulation by law or by administrative tribunals will follow. In the second place, we must do our best to impress upon the public, and through the public upon its legislative representatives, that stream pollution is essentially a local problem. It may or may not be an interstate problem, depending upon the locations of the particular industries and the particular streams; but it is a *local* problem and, being a local problem, it should be locally regulated, if at all, and not placed under a Federal bureaucracy."

Emphasizing his contention, Mr. Searles cited the cooperative action between California hydraulic miners in Siskiyou and Trinity counties and the California Fish and Game Commission with respect to the discharge of tailings in the Klamath River. In conclusion, he urged the widest possible publicity of the whole subject, particularly those aspects pertinent to mining that otherwise will not be fully appreciated.

The incidence of the Black-Connery wage-and-hour bills (S. 2475 and H.R. 7200) on the mining industry was analyzed by Edward H. Snyder, general manager of Combined Metals Reduction Company. Considering the broad powers of the proposed Labor Standards Board, the speaker found that if it should order a five-day week in metal mining, the immediate results would be to (a) decrease the earnings of employees by $300 to $400 per year; (b) decrease production of mineral products; (c) increase the cost of production; (d) decrease employment in prospecting and discourage investment of capital for developing new mineral deposits; (e) greatly aggravate the housing shortage that now exists in practically every camp in the West; and (f) increase further the accident rate by forcing the industry to use an excessive percentage of inexperienced men. Mr. Snyder felt that the proposed legislation would be unworkable in mining, and that the industry should be exempt, with agriculture and fishing, from its provisions if enacted.

The Wagner Act was discussed by William W. Ray, of Salt Lake City, who reviewed Supreme Court decisions upholding its constitutionality. He concluded that: "It is hardly conceivable that a large smelting company, drawing its ores from many states, reducing them and shipping the bullion in interstate commerce for refinement, would not come within the provisions of the Wagner Act. On the other hand, it is entirely within the logic of the statute that a mine within a state, taking its ore from the ground, shipping intrastate to the smelter and being there paid for its product, would be held to be so far removed from the stream of interstate commerce as to free it from the provisions of the Wagner Act."

Mine Taxation

Mine taxation, Federal finance, and depletion filled the program of a whole session and drew a large and attentive audience. The major theme was the mounting cost of taxation required by Federal spending. W. Mont Ferry, managing director of Silver King Coalition Mines, listed thirteen taxes now paid by a Utah mining enterprise. These taxes amount to 30 per cent of the net taxable income and to more than 53 per cent of the payroll. Specific criticism was directed against the undistributed profits tax, under which it will be impossible to accumulate reserves such as were used to continue operations and maintain employment in the current depression. New mining ventures are handicapped by this law, which the speaker described as "a red

light to all capital, warning it to keep out."

A notable analysis of Federal finance and taxation was presented by Ellsworth C. Alvord, of Washington, D. C. He presented figures to show that the United States has concluded the seventh consecutive year of Federal deficits at an average of more than three billion dollars per annum. "In those seven years we have spent in excess of 46 billion dollars," said Mr. Alvord. "In 1936 the Federal Government spent $2.16 for every dollar it took in, and is currently spending $1.53 for every dollar of receipts."

On the subject of taxation Mr. Alvord recommended (1) the substitution of a reasonable tax upon capital gains; (2) repeal of the present capital stock-excess profits taxes; (3) immediate repeal of the thoroughly discredited undistributed profits tax. Referring to the last item, the speaker enumerated ten defects in this new and revolutionary form of taxation and denounced it as against public policy.

Despite the fact that depletion based on a percentage of gross income is probably the fairest method of levying income tax on mining companies, it becomes necessary on occasion to defend the principle. For this reason Leo J. Hoban, secretary of the Hecla Mining Company, reviewed the whole matter preliminary to a round-table discussion.

"In every income tax law passed since March 1, 1913," said Mr. Hoban, "the principle of depletion has been recognized as justly applicable to the natural resource industries. The method by which the allowance should be determined has undergone changes, but the underlying theory itself has not been disturbed, or even seriously attacked. On the contrary, Congress after exhaustive hearings, has consistently broadened the application of the allowance for the purpose of insuring equal justice to all taxpayers in the industries affected."

Difference of opinion has existed whether depletion should be based on net or gross income from mining property, and both bases have been advocated. Finally, however, Congress decided to base depletion allowances for metal mines on 15 per cent of gross income, with the limitation that it would not exceed 50 per cent of net income. In making its first income tax return a company must elect whether it wishes the depletion allowance to be computed on the basis of percentage or on another base already established, and in case no such election is made, depletion will automatically be based on cost. The election once made cannot be changed in the future.

Compared with the method of levying tax by appraisal of mine value, the percentage depletion system is so much more simple and equitable to all concerned that it should manifestly be maintained.

Scraper Loading at Climax

At a session devoted to technical papers, W. E. Romig, general superintendent of the Climax Molybdenum Company, related his company's experience with scraper loading. Ore is mined by an induced caving system. An area of any convenient size is undercut, ranging from 2,500 to 75,000 sq.ft., the size depending on the character of the ground or the speed with which the block is desired. Sufficient pillars are left to support the block. After the undercutting is completed the pillars are drilled and blasted simultaneously, allowing the ore to cave from its own weight. The ore is drawn off through fingers to grizzlies or slushing drifts.

A standard system of chutes and grizzlies had been used satisfactorily on the upper levels of the mine, but when operations began on the Phillipson level it became apparent that this system would not be satisfactory. Hence a scraper system was developed, consisting of haulage drifts driven through the orebody on 200-ft. centers, with scraper drifts at right angles to the haulage drifts on 75-ft. centers. The bottom of the scraper drifts is eight feet above the track in the haulage drifts and one foot above the top of the cars. Fingers are driven from the scraper drifts to the stope floor. Ore flows down the stope fingers and is scraped into cars from both sides of the haulage drifts.

Advantage and disadvantages of the new system worked out as predicted. For the first seven months of this year, the operating cost of the scraper system has been $0.0273 per ton less than that of the chute and grizzly system. Saving on development has been $0.0436 per ton, or a saving of $0.0709 per ton on total costs. Reduction in cost and increased safety in operation are decisively in favor of the scraper system.

Space is not available to review other topics discussed. Mention should be made, however, of the well-organized trips of inspection to local mining, milling, and smelting centers. Utah had much to show visiting engineers, and was generous with its courtesies, entertainment, and hospitality.

Digest of American Mining Congress Declaration of Policy

Taxation . . . For revenue only; not to redistribute wealth, or to force social reform, or to control industry. Restoration of flat-rate corporation tax, and right to make consolidated returns. Condemnation of tax on undistributed profits. Continuance of Board of Tax Appeals as independent, non-political agency for settling disputes between taxpayer and Government. Approval of system of percentage depletion for the mining industry established in the Revenue Act of 1932.

Federal Activities . . . Opposition to government by executive order or administration decree. Disapproval of tendency of Government to regulate business and to engage in business in competition with private industry.

Trade Agreements . . . Changes in tariff rates should be proposed only after public hearings and should become effective only after approval by Congress.

Money . . . Opposition to managed currency. Approval of bimetallic base. Continuation of purchase by Government of newly mined domestic gold and silver.

Labor . . . Essential unity of interest of employer and employee. Organizations of both groups should be subject alike to legal responsibility for their conduct. Employees should be free from coercion from all sources. Opposition to control of wages and hours by legislative fiat. Approval of best possible working conditions and measures to protect health and safety of employees.

Social Security Reserve . . . Oppose ultimate accrual of huge reserve fund under existing provisions of Social Security Act. Urge immediate consideration of amendment to provide only sufficient income to administer Act on pay-as-you-go basis.

Water Pollution . . . Approve the principle of maintaining purity of water sources. Favor State rather than Federal regulation and control.

Roads . . . Approve expenditure of public funds for adequate public highways, and urge extension of public aid to construction of roads beneficial to mining industry.

Public Domain . . . Endorse present policy of locating mining claims and granting patents. Disapprove withdrawal of public lands from mineral entry.

Sec . . . Urge simplification of requirements and procedure for registration of mining securities by Securities and Exchange Commission, in order to avoid prohibitive expense and unreasonable delays.

Economic Stability . . . Essential to restoration of confidence are: balanced budgets, stable money, sound legislation, impartial administration of the law, and encouragement of private enterprise and initiative.

MONTHLY COMMENT • DAILY AND AVERAGE MONTHLY

Summary of the

MARKETS

SEPTEMBER was a month of general disappointment to operators in non-ferrous metals. The expected seasonal recovery in business did not take place, and with production keyed to a high level, buyers became skeptical. In addition, war scares moderated and the security markets broke badly, all of which served to change the picture to one that favored buyers. In other words, it is becoming evident that production has been stimulated sufficiently to take care of the ordinary needs of industry.

Copper sold down to 12c., Connecticut Valley basis, a drop of 2c. per pound from the quotation that prevailed here since April 29. The European price set the pace for the decline. On the last two days of the month business was booked abroad at prices ranging from 11.750c. to 12.200c., c.i.f. usual ports of destination. The copper statistics (consult page 65) show that production has more than caught up with apparent consumption. The foreign group in the control plan announced officially on Oct. 1 that production would be curtailed from unlimited output to 105 per cent of the basic quotas. Immediate action was taken in the United States to restrict output. This news steadied the market. The price here advanced on the last day of September to 12½c., though not before a fair quantity sold at 12c. The decline in the domestic price from 14c. to 13c. was unanimous, but, when the custom smelter who initiated the first open break in the price moved down to 12c., all except one small mine producer withdrew from the market by holding to the nominal 13c. level. Domestic copper sales for September totaled 28,936 tons, against 69,225 tons in August.

Ore imports, following the weakness of the London price, threatened the domestic market for lead and caused the price to fall to 6c., New York.

Zinc imports were fairly large and, together with the drop abroad, the price here was reduced to 6½c., St. Louis.

The *E. & M. J.* index of prices declined from 95.28 in August to 94.33 in September.

UNITED STATES MARKET

1937 Sept.	Electrolytic Copper—Domestic (a)	Electrolytic Copper—Export (b)	Straits Tin New York	Lead—New York	Lead—St. Louis	Zinc St. Louis
1	13.775	13.475	58.625	6.50	6.35	7.25
2	13.775	13.325	58.375	6.50	6.35	7.25
3	13.775	13.350	58.625	6.50	6.35	7.25
4	13.775	13.375	58.625	6.50	6.35	7.25
6	Holiday	13.400	Holiday	Holiday	Holiday	Holiday
7	13.775	13.450	58.500	6.50	6.35	7.25
8	13.775	13.550	58.750	6.50	6.35	7.25
9	13.775	13.575	59.125	6.50	6.35	7.25
10	13.775	13.525	59.625	6.50	6.35	7.25
11	13.775	13.550	59.625	6.50	6.35	7.25
13	13.775	13.525	59.625	6.50	6.35	7.25
14	13.775	13.450	59.785	6.50	6.35	7.25
15	13.775	13.350	59.875	6.50	6.35	7.25
16	13.775	13.050	59.300	6.50	6.35	7.25
17	13.775	12.800	59.300	6.50	6.35	7.25
18	13.775	12.950	59.250	6.50	6.35	7.25
20	13.775	12.650	58.675	6.50	6.35	7.25
21	13.775	12.625	59.675	6.50	6.35	7.25
22	13.775	12.625	59.675	6.50	6.35	7.25
23	13.775	12.575	59.375	6.50	6.35	7.25
24	13.025 @ 13.775	12.525	57.975	6.25	6.10	7.25
25	13.775	12.525	57.750	6.25	6.10	7.25
27	12.775	12.500	57.625	6.00	5.85	7.25
28	12.775	12.450	57.750	6.00	5.85	7.25
29	11.775	11.700	55.625	6.00	5.85	6.50
30	11.775 @ 12.275	11.700	55.750	6.00	5.85	6.50
For month Average	13.530	12.984	58.675	6.400	6.250	7.190
Sept.	**AVERAGES FOR WEEK**					
1	13.775	13.467	58.583	6.500	6.350	7.250
8	13.775	13.408	58.575	6.500	6.350	7.250
15	13.775	13.496	59.610	6.500	6.350	7.250
22	13.775	12.783	59.313	6.500	6.350	7.250
29	13.046	12.379	57.683	6.167	6.017	7.125
Sept.	**CALENDAR WEEK AVERAGES**					
4	13.775	13.396	58.542	6.500	6.350	7.25
11	13.775	13.508	59.125	6.500	6.350	7.25
18	13.775	13.188	59.523	6.500	6.350	7.25
25	13.713	12.588	58.854	6.417	6.267	7.25

SILVER, GOLD, AND STERLING EXCHANGE
NEW YORK AND LONDON

1937 Sept.	Sterling Exchange "Checks"	Sterling Exchange "90-day demand"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	4.96250	4.94875	44.750	19.7500	140s ½d	$35.00
2	4.96125	4.94750	44.750	19.7500	140s ½d	35.00
3	4.95750	4.94250	44.750	19.8125	140s 3 d	35.00
4	4.95750	4.94375	(e)	19.8750	140s 2½d	35.00
6	Holiday	Holiday	Holiday	19.8125	140s 3 d	Holiday
7	4.95375	4.94000	44.750	19.9375	140s 3 d	35.00
8	4.94750	4.93375	44.750	19.9375	140s 5½d	35.00
9	4.94500	4.93125	44.750	19.9375	140s 4 d	35.00
10	4.94500	4.93250	44.750	19.9375	140s 7½d	35.00
11	4.94500	4.93250	(e)	19.9375	140s 7 d	35.00
13	4.94875	4.93750	44.750	19.8750	140s 6 d	35.00
14	4.95125	4.94000	44.750	19.9375	140s 3½d	35.00
15	4.94625	4.93625	44.750	19.9375	140s 6 d	35.00
16	4.95000	4.94000	44.750	20.0000	140s 5 d	35.00
17	4.96000	4.95125	44.750	20.0000	140s 3½d	35.00
18	4.96000	4.95000	(e)	19.8750	140s 1 d	35.00
20	4.95625	4.94625	44.750	19.8125	140s 2 d	35.00
21	4.95500	4.94750	44.750	19.8125	140s 3 d	35.00
22	4.95125	4.94250	44.750	19.8750	140s 3½d	35.00
23	4.94750	4.94000	44.750	19.9375	140s 6 d	35.00
24	4.94500	4.93750	44.750	19.9375	140s 6½d	35.00
25	4.95125	4.94375	(e)	19.9375	140s 6 d	35.00
27	4.95000	4.94250	44.750	19.9375	140s 4½d	35.00
28	4.94500	4.93750	44.750	19.8750	140s 6½d	35.00
29	4.94500	4.93500	44.750	19.8750	140s 7 d	35.00
30	4.94875	4.93875	44.750	19.8125	140s 7½d	35.00
Average for Mo.	4.95145	.....	44.750	19.889	.....	35.00
Sept.	**AVERAGES FOR WEEK**					
1	4.96750	.....	44.750	.....	.....	.....
8	4.95550	.....	44.750	.....	.....	.....
15	4.94688	.....	44.750	.....	.....	.....
22	4.95542	.....	44.750	.....	.....	.....
29	4.94720	.....	44.750	.....	.....	.....

Calendar week averages: New York Silver, Sept. 4th, 44.750; 11th 44.750; 18th, 44.750; 25th, 44.750.

(e) No quotation (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis, add 0.225c. per pound, the average differential for freight and interest charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Most sales in the foreign market are made on the basis of c.i.f. usual ports of destination—Hamburg, Havre, and Liverpool. The c.i.f. basis commands a premium of 0.300c. per pound above our refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *E. & M. J.* average for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly mined domestic. Under Executive order issued April 24, 1935, the U. S. Government's price on newly mined domestic silver was established at 77.57. Handy & Harman's quotation for domestic silver, 999 fine, was 77c. per ounce throughout September.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125 per ounce.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

1937 Sept.	COPPER Standard Spot	COPPER Standard 3 Mo.	COPPER Electro Bid	TIN Standard Spot	TIN Standard 3 Mo.	LEAD Spot Buyers	LEAD Spot Sellers	LEAD 3 Mo. Buyers	LEAD 3 Mo. Sellers	INC Spot Buyers	INC Spot Sellers	INC 3 Mo. Buyers	INC 3 Mo. Sellers
1	55.3125	55.5625	61.2500	261.7500	261.0000	21.7500	21.8125	21.9375	22.0000	22.8125	22.8750	23.0000	23.0625
2	54.6875	54.9375	60.5000	259.0000	258.5000	21.6875	21.8125	21.9375	22.0000	22.4375	22.5000	22.6250	22.7500
3	54.5000	54.7500	61.0000	260.0000	259.0000	21.6250	21.6875	21.7500	21.8125	22.4375	22.5000	22.6250	22.6875
6	55.1250	55.3750	61.2500	260.5000	259.5000	21.7500	21.8125	21.8750	21.9375	22.6875	22.7500	22.8125	22.8750
7	56.0000	56.1250	61.7500	260.5000	259.5000	21.8750	21.9375	22.0000	22.0625	22.9375	23.0000	23.1250	23.1875
8	56,5625	56,5625	62,2500	260,5000	259,5000	22,3125	22,4375	22,3750	22,4375	23,1875	23,2500	23,4375	23,5000
9	55.6250	55.6875	61.7500	261.5000	260.2500	22.0000	22.1250	22.0625	22.1250	22.7500	22.8125	23.0000	23.0625
10	55.6250	55.6875	62.0000	263.2500	262.2500	21.8750	21.9375	21.8750	21.9375	22.8125	22.8750	23.1250	23.1875
13	55,1875	55.3125	62.0000	264.2500	263.5000	21.5000	21.6250	21.5000	21.6250	22.4375	22.5000	22.6875	22.7500
14	54.9375	55.0000	62.0000	264.0000	263.5000	21.2500	21.3125	21.3125	21.3750	22.0000	22.0625	22.2500	22.3125
15	54.5625	54.6250	61.0000	264.3750	263.7500	21.1250	21.1875	21.1250	21.1875	21.8750	21.9375	22.0625	22.1250
16	53.1250	53.3125	58.5000	262.5000	262.0000	20.5000	20.6250	20.5000	20.5625	21.2500	21.3750	21.5000	21.6250
17	52.4375	52.5625	58.0000	261.0000	260.3750	20.2500	20.3125	20.2500	20.3125	21.0000	21.0625	21.1875	21.2500
20	50.2500	50.3125	56.5000	257.7500	257.0000	19.8750	20.0000	20.0000	20.0625	20.0625	20.1250	20.2500	20.3125
21	50.6250	50.6875	56.5000	260.2500	258.7500	20.1875	20.3125	20.3125	20.3750	20.2500	20.3125	20.5000	20.5625
22	52.0625	52.0625	57.5000	260.7500	259.2500	20.7500	20.8125	20.8125	20.8750	20.6875	20.8125	21.0000	21.0625
23	51.8125	51.8125	57.5000	260.6250	259.2500	20.8750	20.9375	20.9375	21.0000	20.4375	20.5000	20.6875	20.7500
24	51.1875	51.1875	57.5000	257.0000	256.2500	20.5625	20.6250	20.6250	20.6875	20.1875	20.3125	20.4375	20.5000
27	50,6250	50,6250	56.5000	252.0000	251.0000	20.2500	20.3125	20.3125	20.3750	19.8125	19.9375	20.0625	20.1250
28	50.5000	50.5000	56.0000	254.7500	253.5000	20.2500	20.3125	20.2500	20.3125	19.8750	20.0000	20.0000	20.1250
29	47.7500	47.7500	53.0000	246.0000	244.5000	19.4375	19.5000	19.3750	19.4375	19.1250	19.1875	19.1250	19.1875
30	47.2500	47.2500	53.0000	244.5000	243.0000	19.1875	19.2500	19.1250	19.1875	19.0000	19.1250	19.0625	19.1250
Av'ge for month	52.989	.....	58.966	258.943	.....	20.990		21.044		21.406		21.607	

CURRENT PRICES—MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(October 1, 1937)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb. ..... 20c.
Antimony, domestic, spot, lb. ..... 17.375c.
Bismuth, ton lots, lb. $1.00
Cadmium, lb. ..... $1.25 @$1.60
Calcium, lb., ton lots 98 @ 99 per cent. ..... 75c.
Chromium, 97 per cent grade, lb. ..... 85c.
Nickel, electrolytic cathodes, lb. ..... 35c.
Magnesium, 99.8 per cent, carloads, lb. ..... 30c.
Palladium, troy oz. $24.00
Platinum, (Official quotation) troy oz. $51.00
Quicksilver, flask of 76 lb., 100 flasks or more ..... $88.00@$89.00
Radium, mg. radium content $40.00
Selenium, 99.5 per cent, lb. $2.00
Silicon, minimum 97 per cent, spot, lb. ..... 16.50c.
Tellurium, lb. ..... $1.75@$2.00
Thallium, 100 lb. or more, lb. $6.50
Titanium, 96 to 98 per cent, lb. $6.00
Zirconium, commercially pure, lb. $7.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton ..... $30.00@$35.00
Chrome Ore, 45 @ 47 per cent, c.i.f. Atl. ports, long ton ..... $21.00@$22.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:
- Old Range bessemer $5.25
- Mesabi bessemer $5.10
- Old Range non-bessemer $5.10
- Mesabi, non-bessemer $4.95

Lead (Galena) 80 per cent Joplin, Mo., ton $70.31
Manganese Ore, c.i.f. Atlantic ports, long ton unit:
- 52 @ 55 per cent ..... 52c.
- 50 @ 52 per cent ..... 52c.
- 44 @ 48 per cent ..... 46c.

Molybdenum Ore, 90 per cent, per lb. of contained MoS_2 ..... 42c.
Tungsten Ore, per unit of WO_3:
- Chinese duty paid ..... *a*$35.00
- Domestic Scheelite ..... *a*$34.00

Vanadium Ore, per lb. of contained V_2O_5 ..... 27½c.
Zinc, Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton. $42.50
(a) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb. 3c
Cobalt Oxide, 70 @ 71 per cent, lb. ..... $1.67@$1.77
Copper Sulphate, 100 lb. $5.00
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb. $1.34
Sodium Sulphate, bulk, ton ..... $13.00@$15.00

ALLOYS

Beryllium Copper, Master alloy, 2.5 to 3 per cent Be, per lb. of contained Be $23.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, lb. ..... 10½c.
Ferromanganese, 78 @ 82 per cent, gross ton $102.50
Ferromolybdenum, 50 @ 60 per cent Mo, lb. of Mo contained ..... 95c.
Ferrosilicon, 50 per cent, gross ton $69.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained ..... Nominal

NON-METALLIC MINERALS

Asbestos, f.o.b. mines ton:
- Canadian (Quebec)
  - Crude No. 1 ..... $550@$600
  - Crude No. 2 ..... $200@$225
  - Spinning fibers ..... $90@$170
  - Paper stock ..... $32.50@$37.50
  - Shorts ..... $11@$14.50
- Vermont
  - Shingle stock ..... $47.50.....
  - Paper stock ..... $35 @.....
  - Cement stock ..... $23 @.....

Barytes, long ton:
- Georgia, crude $7.00
- Missouri, 90 per cent $BaSO_4$, less than 1 per cent iron ..... $6.00@$7.00

Bauxite, long ton:
- Domestic, chemical, 55 @ 58 per cent ..... $6.50@$7.50
- Domestic, abrasive, 70 @ 84 per cent ..... $12.50@$15.00
- Dalmatian, 50 @ 55 per cent ..... (a)$6.50@$7.50
- French, 56 @ 59 per cent ..... (a)$8.00@ 9.00

China Clay, f.o.b. mines, ton:
- South Carolina and Georgia, bulk ..... $6.50@$8.50
- Delaware, No. 1 ..... $14.00@.....

Feldspar, bulk, ton:
- Potash feldspar, 200 mesh $17.00
- Glass-spar, white, 20 mesh $11.75

Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton $20.00
Fuller's earth, f.o.b. Georgia or Florida, ton ..... $7.00@$14.00
Magnesite, per ton:
- Dead-burned, f.o.b. California ..... $25.00@.....
- Dead-burned, f.o.b. Washington ..... $25.00@.....

Mica, per lb., North Carolina, No. 1 and 2 quality:
- 1½ x 2 in. ..... 15@40c.
- 2 x 2 in. ..... 30@60c.
- 3 x 3 in. ..... 75@$1.20
- 3 x 4 in. ..... $1.00@$1.40
- 4 x 6 in. ..... $2.00@$2.50
- White, ground, 70 mesh, ton ..... $60.00@$80.00

Ocher, Georgia, ton ..... $19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports ..... (a) 12@12½c
Silica, water-floated, in bags, 325 mesh, ton ..... $16.00@$40.00
Sulphur, Texas mines, long ton ..... $18.00@.....
Talc, f.o.b. works, ton:
- New York, double air-floated, 325 mesh ..... $12.00@$15.00
- New Jersey, mineral pulp ..... $8.00@$10.00
- Vermont, extra white, 200 mesh ..... $9.00@ $9.50

Tripoli, Missouri, ton:
- 40 mesh, cream colored ..... $15.00@.....
- 200 mesh, cream colored ..... $25.00@.....

(a) Nominal.

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:
- Bessemer $24.50
- Basic $23.50
- No. 2 Foundry $24.00

Steel, base prices, Pittsburgh:
- Billets, gross ton $37.00
- Structural shapes, 100 lb. $2.25
- Bars, 100 lb. $2.45

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1936	1937	1936	1937	1936	1937
January	47.250	44.913	20.250	20.734	496.115	490.670
February	44.750	44.750	19.796	20.083	499.908	489.307
March	44.750	45.130	19.663	20.677	496.952	488.412
April	44.892	45.460	20.245	20.740	494.139	491.524
May	44.869	45.025	20.248	20.346	496.850	493.835
June	44.750	44.818	19.770	20.022	501.817	493.404
July	44.750	44.750	19.590	19.986	502.178	496.582
August	44.750	44.750	19.490	19.848	502.519	498.043
September	44.750	44.750	19.579	19.889	503.455	495.145
October	44.750	.....	19.977	.....	489.755	.....
November	45.431	.....	21.050	.....	488.727	.....
December	45.352	.....	21.238	.....	490.670	.....
Year	45.087	.....	20.075	.....	496.924	.....

New York quotations for silver not eligible for sale to U. S. Government, cents per ounce troy, 999 fine. London, pence per ounce sterling silver 925 fine. Sterling exchange in cents.

COPPER

	F.O.B. Refinery, Electrolytic				London Spot			
	Domestic		Export		Standard		Electrolytic (a)	
	1936	1937	1936	1937	1936	1937	1936	1937
January	9.025	12.415	8.358	12.112	34.706	51.497	38.788	56.497
February	9.025	13.427	8.566	13.828	35.313	59.225	39.463	64.013
March	9.025	15.775	8.708	16.590	36.040	72.339	40.227	76.167
April	9.169	15.121	8.849	14.692	36.975	62.506	41.131	66.614
May	9.275	13.775	8.819	13.999	36.690	61.118	40.839	63.684
June	9.275	13.775	8.790	13.492	36.324	55.696	40.357	61.409
July	9.352	13.775	8.993	13.817	37.217	56.412	41.228	62.807
August	9.525	13.775	9.297	13.926	38.259	57.143	42.375	63.595
September	9.525	13.530	9.523	12.984	38.915	52.989	43.267	58.966
October	9.563	.....	9.669	.....	40.980	.....	45.295	.....
November	10.161	.....	10.349	.....	43.932	.....	48.467	.....
December	10.763	.....	10.835	.....	45.946	.....	50.364	.....
Year	9.474	.....	9.230	.....	38.441	.....	42.650	.....

New York quotations, cents per pound. London, pounds sterling per long ton. (a) Bid quotation.

LEAD

	New York		St. Louis		London			
	1936	1937	1936	1937	1936 Spot	1936 3 Mos.	1937 Spot	1937 3 Mos.
January	4.500	6.000	4.350	5.850	15.397	15.494	27.272	27.150
February	4.515	6.239	4.365	6.089	16.022	16.141	28.319	28.328
March	4.600	7.190	4.450	7.040	16.608	16.767	33.027	32.979
April	4.600	6.175	4.450	6.025	16.097	16.234	26.014	25.878
May	4.600	6.000	4.450	5.850	15.530	15.601	24.000	23.891
June	4.600	6.000	4.450	5.850	15.170	15.259	22.878	22.759
July	4.600	6.000	4.450	5.850	15.856	15.954	23.932	23.703
August	4.600	6.452	4.450	6.302	16.772	16.859	22.606	22.670
September	4.600	6.400	4.450	6.250	18.009	17.974	20.990	21.044
October	4.631	.....	4.488	.....	18.446	18.375	.....	.....
November	5.114	.....	4.964	.....	21.723	21.693	.....	.....
December	5.554	.....	5.406	.....	25.560	25.503	.....	.....
Year	4.710	.....	4.560	.....	17.599	17.655	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton.

TIN

	Straits, New York		Standard, Spot, London	
	1936	1937	1936	1937
January	47.234	50.925	209.731	229.350
February	47.962	52.010	207.081	233.750
March	48.037	63.043	213.080	282.988
April	46.963	59.172	209.313	267.136
May	46.352	55.651	202.429	250.645
June	42.204	55.851	183.167	249.852
July	43.021	59.245	185.957	263.540
August	42.579	59.465	183.731	264.595
September	44.754	58.675	194.676	258.943
October	44.975	.....	201.193	.....
November	51.392	.....	230.869	.....
December	51.823	.....	232.108	.....
Year	46.441	.....	204.445	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		London			
	1936	1937	1936 Spot	1936 3 Mos.	1937 Spot	1937 3 Mos.
January	4.848	5.847	14.488	14.719	21.153	21.281
February	4.859	6.465	15.125	15.391	25.122	25.323
March	4.900	7.381	159.83	16.190	33.188	33.405
April	4.900	7.010	15.181	15.334	26.216	26.344
May	4.900	6.750	14.536	14.777	23.092	23.365
June	4.880	6.750	13.896	14.122	21.409	21.528
July	4.783	6.923	13.579	13.826	22.568	22.693
August	4.800	7.192	13.528	13.759	24.140	24.290
September	4.850	7.190	13.906	14.159	21.406	21.607
October	4.850	.....	14.554	14.835	.....	.....
November	4.974	.....	16.301	16.554	.....	.....
December	5.273	.....	17.957	18.145	.....	.....
Year	4.901	.....	14.920	15.151	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1936	1937	1936	1937
January	105.000	90.000	20.000	19.500
February	105.000	90.000	20.000	19.500
March	105.000	101.667	20.000	20.000
April	105.000	105.000	20.000	20.000
May	105.000	105.000	20.000	20.000
June	105.000	130.962	20.000	20.000
July	93.462	142.500	20.000	20.000
August	90.000	142.500	20.000	20.000
September	90.000	142.500	20.000	20.000
October	90.000	.....	20.000	.....
November	90.000	.....	20.000	.....
December	90.000	.....	20.000	.....
Year	97.789	.....	20.000	.....

Aluminum in cents per pound, 99 per cent grade. Cadmium, cents per pound.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1936	1937	1936	1937	1936	1937
January	12.736	14.130	76.769	90.250	36.885	50.404
February	12.967	14.563	77.000	91.000	35.000	64.360
March	13.072	16.375	77.000	91.778	34.115	58.000
April	12.673	16.043	76.731	92.000	32.846	58.000
May	12.410	14.830	74.940	95.520	32.000	54.800
June	11.707	14.702	74.192	96.654	36.346	53.000
July	11.245	14.803	73.423	93.904	39.308	50.115
August	11.125	15.327	73.923	91.423	49.577	51.000
September	11.740	16.555	85.280	89.020	68.960	51.000
October	12.058	.....	89.240	.....	54.074	.....
November	12.233	.....	90.250	.....	48.000	.....
December	12.918	.....	90.250	.....	48.000	.....
Year	12.240	.....	79.917	.....	42.926	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1936	1937	1936	1937	1936	1937
January	20.00	21.50	19.00	20.50	19.50	21.00
February	20.00	21.50	19.00	20.50	19.50	21.00
March	20.00	24.50	19.00	23.20	19.50	23.70
April	20.00	24.50	19.00	23.50	19.50	24.00
May	20.00	24.50	19.00	23.50	19.50	24.00
June	20.00	24.50	19.00	23.50	19.50	24.00
July	20.00	24.50	19.00	23.50	19.50	24.00
August	20.00	24.50	19.00	23.50	19.50	24.00
September	20.00	24.50	19.00	23.50	19.50	24.00
October	20.00	.....	19.00	.....	19.50	.....
November	20.23	.....	19.23	.....	19.73	.....
December	21.00	.....	20.00	.....	20.50	.....
Year	20.103	.....	19.103	.....	19.603	.....

Iron in dollars per long ton. F. o. b. Mahoning and Shenango Valley furnaces.

PERSONAL ITEMS

Donald F. Irvin was in England and on the Continent during the past summer.

John C. Alexander has been promoted to the post of superintendent of the United Paracale Mining Company, Paracale, Camarines Norte, P. I.

W. R. Lindsay has been appointed resident manager of Granby Consolidated M. S. & P. at Copper Mountain, B. C.

R. E. Barthelemy, who returned from French Indo-China early this year, sailed from New York on Sept. 24 on the S.S. "Santa Inez" for Lima, Peru.

Oscar Hershey, of San Francisco, has been in the Mountain City district, Nevada, studying the geology of that area.

T. O. Seiberling has accepted a position in the engineering department of the Leadwood division of the St. Joseph Lead Company.

E. E. Barker, consulting engineer, has returned to Berkeley, Calif., after a professional trip to Fairbanks, Alaska.

Max Kraut, metallurgical engineer, returned recently to his San Francisco headquarters after a protracted professional stay in Colombia, S. A.

D. L. Forrester, metallurgical engineer, South Pasadena, Calif., is now in Manila, P. I., where he may be addressed in care of Elizalde Company.

L. Mozin writes from Liege, Belgium, that the Ecole des Mines will celebrate its 100th anniversary next November.

J. K. Wadley, of Texarkana, Ark., has been at the Jumbo mine, at Awakening, Nev. He and **H. L. Hunt,** of Tyler, Tex., are optionees.

Alex. Fraser, who has been on the staff of Great Boulder Pty., Kalgoorlie, since 1909, is now manager of Youanmi G.M. Company, Youanmi, W.A.

Courtnay E. Cleveland has resigned the position of geologist for Bralorne Mines, Ltd., Bridge River, B. C., to take up postgraduate studies at McGill University.

H. L. Burmeister, mining engineer, Kernville, Calif., has joined the staff of Consolidated Mines, Inc., Camarines Norte, P. I., and is now employed at the Tumbuga mine.

George F. Weaton, Jr., has resigned his position with the Andrews Mining & Milling Company, of Picher, Okla., to accept the position of junior engineer for the Cerro de Pasco Copper Corporation at Casapalca, Peru.

Stanly A. Easton, president and general manager of Bunker Hill & Sullivan Mining and Concentrating Company, Kellogg, Idaho, has relinquished the responsibilities of the last-named position and will from now on devote his time and energies to executive work

STANLY A. EASTON

and the development of properties owned by the company. He is succeeded as general manager by **H. I. Altshuler,** formerly on the board of Cia. de Real del Monte y Pachuca, at Pachuca, Hidalgo, Mexico. Mr. Easton succeeded Albert Burch as manager of the company in 1903, in which capacity he served for 34 years. He assumed the duties of the presidency also on the death of Fred W. Bradley, of San Francisco. During Mr. Easton's direction of the destinies of Bunker Hill & Sullivan the property was developed into the greatest lead-silver mine in the world. A biographical sketch of his career was presented in *Engineering and Mining Journal* of Sept. 24, 1921, on page 503.

E. M. Lindenau has resigned as manager of Minas Pampa Grande, Bolivia, and will return to the United States in October. He expects to engage in mining in Arizona.

W. J. Loring, president and managing director of the Arizona Comstock Corporation, has been on a motor trip to districts on the California Mother Lode where he operated formerly.

T. D. Overton, engineer graduate of the Mackay School of Mines at Reno, Nev., has been appointed assistant superintendent for the Reliance Mining Company at Manhattan.

Henri F. Withington has relinquished his position as mill superintendent at the Markeson mine, near Ludlow, Calif., which closed down to develop more ore reserves, and is now doing assaying at the Johnson mine, three miles from Octave, Ariz.

R. Pitman Hooper, for some years with Broken Hill South, Ltd., is now senior assistant underground manager at the Zinc Corporation, Broken Hill.

N. M. Worner, formerly senior demonstrator in civil engineering at the University of Melbourne, has joined the geological staff of Western Mining Corporation, Kalgoorlie, W.A.

Paul R. Murphy, geologist and manager for the Eastern Exploration Company, a Calumet & Hecla Consolidated Copper subsidiary, has returned to Goldfield, Nev., where his company is developing gold properties.

Fred Wise, until recently superintendent of the Original Amador mine, Amador City, Calif., has been appointed superintendent of Getchell Mine, Inc., Golconda, Nev., in succession to L. R. Robins.

George W. Sullivan, mining engineer, recently returned to the United States from Mexico and is now employed by Ralph E. Davis. He may be addressed care of Box 93, Helena, Mont.

I. Partanen was recently appointed superintendent of the Ash Peak branch of Veta Mines, Inc., the property of which company is near Duncan, Ariz.

John C. Brennon, one of the directors of the International Mining Corporation, of 630 Fifth Ave., New York City, returned recently from an inspection trip throughout the West.

H. A. Johnson and **William Sharp,** respectively manager and field engineer for the Tonopah Mining Company, lately examined mining properties near Battle Mountain in Lander County, Nev.

T. H. Oxnam, for the past three months resident manager, Royal Paracale Mines, Inc., Masbate division, is now chief engineer for the company, in charge of operations of both Masbate and Paracale divisions.

George G. Morse, of Denver, has been visiting the Silverado mine of the Sierra Consolidated Mines, Inc., near the Nevada line, in Mono County, Calif. He is a director and associated with John J. Raskob in control of the project.

Arthur J. Yahn, assistant superintendent of Shenandoah-Dives Milling Company mill at Silverton, Colo., succeeds to the superintendency on the death of Edward Charles Wheeler. Mr. Yahn is succeeded in his former position by **Dan M. Kentro,** former assayer and metallurgical investigator.

Claude Bean, who has been assistant superintendent of concentration at Minas de Matahambre, has returned to the University of Southern California for further study.

P. Malozemoff, metallurgical engineer, Pan-American Engineering Company, who has been visiting the Pato and Asnazu properties of Placer Development, Ltd., in Colombia, S. A., on professional business, has returned to his headquarters at Berkeley, Calif.

Joseph David, mining engineer, formerly with the E. J. Longyear Company and Walker Mining Company, in the Iron Country, is now on the staff of Allied Annie Laurie Gold Mines Company at Sevier, Utah.

George F. Wheaton, Jr., formerly with the Andrews Mining & Milling Company at Picher, has accepted a position as junior mining engineer with the Cerro de Pasco Copper Company and sailed for Peru.

R. M. Hix, mill superintendent for the Soriano controlled Antomok Gold Fields, at Baguio, has been transferred to Rio Guinobatan, Masbate, where he will be mill superintendent for the Masbate Consolidated Mining Company, which is also controlled by the Soriano group.

R. J. Stengl, formerly superintendent at the Barr mine of the Vinegar Hill Zinc Company, near Picher, has taken charge of the sinking of a 350-ft. shaft 12 miles northeast of Elizabethtown, Ill., for the Mahoning Mining Company. An extensive drilling campaign has proved a body of fluorspar.

S. R. Brown, consulting mining engineer to the Union Corporation, London, sailed on Oct. 6 to England on the "Queen Mary". During the past several months Mr. Brown has been examining mineral deposits and prospects in China and the Island of Hainan.

Henry S. Sweet, who recently resigned his position as manager of Cia. Minera de Los Azules, at Santa Barbara, Chihuahua, Mexico, is now located at 5216½ Melrose Ave., Hollywood, Calif. He has just returned to Los Angeles from an examination of two gold properties in northern California and Colorado.

R. S. Handy, superintendent of the Bunker Hill & Sullivan plant at Kellogg, Idaho, and his son, **Raymond P. Handy,** acting as a copartnership, have established a complete test plant for ore examinations and mill design, at North Market St. and Lincoln Road, Morgan Acres, Spokane, Wash. Mr. Handy junior is in charge, under the supervision of his father.

W. E. Winn has taken over the "Carbonate Lead" mine, 1½ miles north of McGill, Nev. Six shipments of 60 per cent lead have been made from the property. Mr. Winn is running a crosscut to tap the ore 400 ft. below the collar of the shaft. The vein is 3 ft. wide.

B. Berthelson has joined the staff of the Zeibright mine, a subsidiary of the Empire Star Mines Company, Ltd., in the Nevada City section of California. He was formerly associated with La Luz Development Corporation in the exploration of properties at Guanajuato, Mexico.

William Russell, chairman of the Dorr-Oliver Company, Ltd., of London, England, returned to London on Sept. 3 after a six weeks' visit to the United States, during the course of which he inspected many metallurgical plants in Canada and the West.

Charles D. Bottomley, also of the Dorr-Oliver staff, and **John D. Grothe,** of Dorr-Oliver, N. V., The Hague, have returned to Europe after similar visits to chemical, metallurgical, and sanitary engineering plants in this country.

John Edward Littlepage recently returned to the United States from Soviet Russia, where he had been employed as consulting mining engineer to Glavzoloto, the Gold Trust of

Photo by Sovfoto
JOHN EDWARD LITTLEPAGE

U.S.S.R. Mr. Littlepage served this industry on various contracts in the last ten years and is the last American mining engineer employed in the non-ferrous industry to leave the Soviet Union.

Harold S. Elford, editor of *Chemical Engineering and Mining Review of Australia,* was a visitor in New York recently, with Mrs. Elford, following a trip to London, Germany, and Italy. Mr. Elford returned to Melbourne via Canada, where he visited some of the large mines in the Dominion.

Dr. L. H. Duschak, formerly superintendent of the Berkeley Station of the United States Bureau of Mines, and now a consulting chemical and metallurgical engineer in San Francisco, has been appointed lecturer in metallurgy in the College of Mining and Metallurgy of the University of California, at Berkeley.

Percy Seibert, general representative at Santiago, Chile, of the Braden Copper Company, was decorated on Sept. 25 by **President Arturo Alessandri,** of Chile, with the Medal of Merit. The honor was conferred "because of Mr. Seibert's valuable services to the Government and to the country, rendered over a long period of years."

J. B. Haffner, manager for the Consolidated Coppermines Corporation at Kimberly, Nev., has been inspecting cinnabar properties in the Bottle Creek district, northern Humboldt County, acquired under option by the Fulton Quicksilver Company, of which he is a director.

Leslie L. Motz, recently in private practice associated with **Ralph L. Motz,** consulting engineer, of Bisbee, Ariz., has accepted a position with the Oregon State Department of Geology and Mineral Industries. He is in charge of the State Assay Laboratory at Baker, an office established to render free assay service to miners and prospectors of the State.

C. C. Cushwa, long identified with mining in the Park City district of Utah, has succeeded **Don Billick** as manager of the Spring Hill mining property, Grass Valley, Calif. The mine is owned by Spring Hill Gold Mines, Inc. Development at the plant includes the sinking of a winze from the 1,100- to the 1,250-ft. level. The 100-ton mill is running on a one-shift basis.

Prof. Jay A. Carpenter, of the Mackay School of Mines of the University of Nevada, assumed the duties of director of the school on Sept. 15. He is occupying the post of **John A. Fulton,** absent on sabbatical leave until Sept. 1, 1938. Professor Carpenter, in common with Mr. Fulton, is a graduate of the University of Nevada. After some years of mining experience in the field he became an instructor in mining at the South Dakota School of Mines. He has been with the Mackay School of Mines since 1926.

John Gillie, consulting engineer for the Anaconda Copper Mining Company, was presented with the Legion of Honor Medal of the Institute at a meeting of the A.I.M.E. held on Sept. 8 at the Butte Country Club. The presentation was made by **R. C. Allen,** president of the Institute, and the occasion marked Mr. Gillies' 50th year as a member of the society. Other speakers included **Harry Gallway,** of Butte, who introduced Mr. Gillie and eulogized him "as the friend of the young engineer," and **Dr. G. B. Waterhouse,** who spoke on modern trends in the iron and steel industry. **Mr. Allen, A. B. Parsons,** of New York, secretary of the A.I.M.E.; and **Dr. Waterhouse,** of Boston, a director, who are on a tour of the West, were the guests of the Columbia Section of the Institute and other mining men on Sept. 9, at a meeting at the plant of the Sunshine Mining Company, near Kellogg, Idaho. The meeting also paid tribute to **Frederick Burbidge,** of Spokane, who has been a member of the Institute for 50 years. He retired as manager of the Federal Mining & Smelting Company a few years ago. Mr. Burbidge was presented with a medal and diploma of the Legion of Honor of the A.I.M.E.

William Campbell, Howe professor of metallurgy at Columbia University, who died on Dec. 16, 1936, left a bequest of $211,247 to the University for the establishment of a fellowship for scientific research.

OBITUARY

D. G. Lumsden, for 25 years secretary of the Mount Lyell Mining & Railway Company, died at Edinburgh on Aug. 9 at the age of 62.

Capt. William H. Holman, of Ishpeming, Mich., mining man and expert in mine-shaft operation, died on Sept. 4 at the age of 61.

J. B. Lightfoot, surveyor for the Atolia Mining Company, Atolia, Calif., was recently killed in a shaft accident at the Atolia tungsten mine.

G. C. Dewey, chief chemist at the Selby smelter of the American Smelting & Refining Company, Selby, Calif., died on July 31.

John G. Williams, of Duluth, died at his home on Aug. 29 at the age of 82. Mr. Williams was active in mining ventures, and was a distinguished member of the bar, and a member of the Board of Regents at the University of Minnesota.

Harold C. George, department head in the School of Mines at the University of Chicago, died in Pittsburgh, Pa., on Sept. 23 at the age of 56. Formerly, he had been an instructor at the Wisconsin State Mining School and at the University of Oklahoma. From 1928 to 1931 he was secretary of the petroleum section of the A.I.M.E.

William Kelly, for the past 60 years active in the mining industry in many fields, died in Iron Mountain, Mich., on Oct. 1 at the age of 83. Mr. Kelly was a native of New York and an alumnus of Yale and Columbia. He was a former president of the A.I.M.E.

R. E. Weniger, president of the St. Elmo Mining Company and postmaster of Wallace, Idaho, for the last two years, died in Wallace on Sept. 25 at the age of 53. Mr. Weniger had long been interested in the development of the silver belt of Idaho, having formerly been employed at the Federal property at Wardner.

Robert K. Humphrey, 76, a mining engineer long associated with mining in Colorado and more recently for many years with the Guggenheim Exploration Company of Mexico, and his wife, Eva May Humphrey, 72, were killed by an automobile accident at Saltair, Salt Lake, Utah, on Sept. 10, while on a trip from California to Utah.

Edward Charles Wheeler, superintendant of the mill of Shenandoah-Dives Mining Company at Silverton, Colo., died at Silverton on Sept. 10. Mr. Wheeler was the son of **E. C. Wheeler,** chairman of the Public Utilities Commission of Colorado, and a grandson of **Walter Wheeler,** a pioneer engineer of Ouray, in that State. He was an alumnus of the Colorado School of Mines (1930) and joined the Shenandoah-Dives organization in 1931.

Charles V. Drew, mining engineer, vice-president and director of Cerro de Paseo Mining Corporation, with which he had been associated since 1904, died in Boston on Sept. 26, following an operation. He would have been 65 years old on Oct. 1. Mr. Drew was graduated from the University of Chicago in 1899 and from the University of Michigan, as a mining engineer, five years later. At the time of his death he was also a vice-president and director of Cerro de Pasco Railway Company and a director of United States Metal Refining Company.

Noak Victor Hybinette, inventor of the Hybinette process for refining nickel, died at Malerno, Italy, on Sept. 7, at the age of 70. He was born at Falun, Sweden. Having established a reputation in the metallurgy of nickel in Norway, he came to the United States where he was made general superintendent of the Orford Copper Company at Bayonne, N. J., which is now merged with International Nickel. He became chief metallurgist in 1904. In recent years he had been president of Hybnickel Alloys Company, of Wilmington, Del., and of Nicralumin Company, of Jackson, Mich., both of which companies he personally organized. The King of Sweden conferred on him the Vasa Orden in recognition of his contributions to metallurgy.

William Loeb, who retired in 1934 from the vice-presidency of the American Smelting & Refining Company, died on Sept. 19 at Glen Cove, Long Island, N. Y. He would have been 71 years old on Oct. 9. Mr. Loeb was born in Albany, N. Y. When 22 years old, he became stenographer of the New York State Assembly. On Theodore Roosevelt's election as Governor of the State, Mr. Loeb was appointed, first, official stenographer and later private secretary to the Governor. In 1909 he was made Collector of the Port of New York. Soon after relinquishing the office, in 1913, Mr. Loeb became identified with the Guggenheim interests. He had been vice-president of American Smelting & Refining until his retirement three years ago.

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Letters

Mining Practice, 1936 — Ring Drilling in Sublevel Stoping

The Editor:

I WAS GLAD TO READ Mr. Mann's comment (*E&MJ* Aug. 1937, p. 44) and appreciate his sending this information. Mr. Mann is correct in stating that ring drilling is not new for enlarging openings, but I do not think that my article stated, or even implied, that the Noranda application of it was "an entirely new development." I simply gave it as an interesting application to stoping methods. So far as I know, the Noranda officials have not claimed that they originated the application, but I believe that they have given the first published information in relation to it.

From Mr. Mann's letter I cannot tell whether the application at Noranda is the same as that used at Mount Isa, but this is not material. Possibly it may be used in other mines, but I have not found any description of it in the mining literature except that given by Noranda Mines. At any rate, the officials of both these mines are to be congratulated on pioneering in an adaptation of drilling that gives promise of adding to both the efficiency and safety of sublevel stoping.

I shall be very much interested to read the description of the Mount Isa method when it is published by the United States Bureau of Mines, and my regret is that Mr. Mann and his associate did not give it publicity at an earlier date. Mining literature is cluttered up with articles which present nothing new, but it would be a great help to the industry if every engineer would promptly publish an account of any new method, or new application of old methods, to mining problems.

W. G. McBRIDE

McGill University,
Montreal, Canada.

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Radium in California?

The Editor:

CONSIDERING that radium is the most precious element in the world and that few persons are acquainted with its mode of occurrence or its determination, it is surprising that more "deposits" of it have not been discovered by newspaper and magazine reporters.

Compared with deposits of "colloidal gold," "green gold," and "sub-atomic gold," a "deposit" of radium should offer far better opportunities to extract sucker money from the public.

It is not unusual for small-town papers to publish unauthenticated news items regarding local developments, but it is regrettable, especially to us of the mining profession, that mining news with as little proved basis as the recent "radium discovery" be given as much nation-wide publicity by so many different and supposedly reliable news agencies.

DWIGHT L. SAWYER

NEW BOOKS

THE MINERAL INDUSTRY, 1936. *Edited by G. A. Roush. McGraw-Hill Book Company, Inc., New York & London. Pp. 750. Price $12.*

THIS is the 45th consecutive annual volume dealing with the statistics, technology, and trade of the mineral industries. Thirty-three authorities have contributed chapters on various mineral commodities from abrasives to zinc. So far as possible an attempt is made to present a world review, although data from the more remote countries are difficult to obtain. Statistical data are compiled from official governmental sources. The reviews of technology, which lend added value to the work, are compiled by authorities from current literature and from personal correspondence. Trade trends and prices are noted in the discussions of specific commodities. Additional aids to the student of shifts in world trade in minerals are found in tables giving United States import tariffs on mineral and metal products, the value of foreign coins, and weight-conversion factors.

MINERALS YEARBOOK 1937. *Compiled under the supervision of H. H. Hughes, Economics and Statistics Branch, United States Bureau of Mines. For sale by the Superintendent of Public Documents, Government Printing Office, Washington, D. C. Pp. 1500. Price $2.25.*

A REVIEW of the mineral industry for the calendar year 1936, based on Government statistics for about 100 metals, minerals and mineral products. In addition to presenting detailed commodity figures, the volume reviews the status of mining in relation to American industry. The current edition also includes detailed data formerly contained in the Statistical Appendix, publication of which has been discontinued.

MINERAL RAW MATERIALS. *Prepared by the staff of the Foreign Minerals Division, United States Bureau of Mines. McGraw-Hill Book Company, Inc., New York, N. Y., and London England. Pp. 342. Price $5.*

THE STRATEGIC IMPORTANCE of minerals in world economy, and the interdependence of nations on sources and markets for minerals, are in themselves adequate reasons for compiling and publishing the most complete data available on the subject. Granting the dullness of mere statistics of this kind, their interpretation nevertheless reveals dramatic consequences of social and economic import, affecting the welfare of nations in peaceful industrial development or in military preparedness.

Significant clues to the world situation in mineral raw materials are to be found in two items: (a) the location of mineral deposits and their national control, and (b) the mineral import trade of the principal countries of the world. If one knows, for example, that in 1934 Germany was the leading producer of aluminum, the United Kingdom the leading importer, and Canada the leading exporter, one can begin to evaluate the social and economic importance of aluminum to those countries. And if one then learns that France is at once the leading producer and exporter of bauxite, and Germany the leading importer, the international relationships of these two commodities are further clarified.

Such is the kind of information to be derived from this book, which, being compiled by a governmental agency, contains the most authoritative information available. The work is divided into two parts: (1) a survey of 32 metals, from aluminum to zinc, and (2) a survey of 12 major industrial countries, from Belgium to the United States. For each metal the survey depicts principal producers, importers, and exporters, gives production by countries, cites industrial uses, and discusses substitutes. For each country there are tables of production and import trade, and a discussion of mineral resources. In order to insure a fair comparison of trends in mineral production and trade, all statistics deal with quantity rather than value. The latter might easily be misleading on account of the violent fluctuations in price and international exchange rates. The book is a valuable contribution to mineral economics, and should prove useful to producers and consumers of mineral raw materials throughout the world.

RAW MATERIALS IN PEACE AND WAR. *By Eugene Staley. Published by Council on Foreign Relations, 45 East 65th St, New York City. Pp. 326. Price $3.*

THIS VOLUME is an outstanding economic interpretation of international raw material problems. It deals with many varieties of commodity, but more importantly with minerals than with any others. Its analysis of the social, economic, and political relationships which influence production and world trade are worthy of the study of every engineer and executive who has anything to do with the policy-making of his company in these commercial areas.

International complications result largely from raw material controversy. This thesis inspired subcommittee effort under the Council on Foreign Relations which has resulted in this volume. The special committee, under the chairmanship of Prof. Charles K. Leith, was made up of outstanding economic investigators, who worked under a special grant from Rockefeller Foundation for the preparation of this American report to the International Institute of Intellectual Cooperation, an agency of the League of Nations. Publication of the book this spring but briefly antedated the Tenth Session of the Conference, which met in Paris at the end of June.

Readers interested in minerals will experience one important disappointment in the perusal of this volume. They may even be shocked to find how much out of date are the statistical facts and illustrative material drawn from the field of mining and mineral trade. But it is quite safe to overlook that unfortunate deficiency, because the principles enunciated are set forth soundly and with exceptional clarity. The economic and political interpretations are, in fact, so usefully presented as to be worthy of thoughtful study, regardless of the obsolescence of much of the illustrative material. This can be true because natural economic principles do not change with mere modification of trade relations.

Readers will also find conspicuously presented much of the opinion of the author and his eminent advisory committee. The book abounds in editorial sentences and near-didactic conclusion. But the author is fair to his readers, for it is quite easy to distinguish between the statements of fact and of opinion. The reader is, therefore, free to draw his own conclusions, if he does not see fit to agree in every detail with the author.

The book is an extremely useful one. The reviewer commends it strongly to the study, not mere reading, on the part of mineral executives, many of whom might have avoided recent pitfalls had they clearly appreciated principles or trade relationship persuasively set forth in this work. R. S. MCBRIDE

PUBLICATIONS

RECEIVED

✦ *The Ochre Deposits of the Riversdale District, Cape Province.* By D. J. L. Vesser. Geological Series, Bulletin 9. Department of Mines, Union of South Africa, Pretoria. Pp. 21, with map. Price, 3d.

✦ *The Pegmatite Area South of the Orange River in Namaqualand.* By T. W. Gevers, F. C. Partridge, and G. K. Joubert. Memoir 31. Geological Survey, Union of South Africa, Pretoria. Pp. 180 with map. Price, 7s. 6d., including map.

✦ *United States Bureau of Mines, Washington, D. C., Information Circulars*: No. 6952: List of Respiratory Protective Devices Approved by the United States Bureau of Mines. No. 6952: Hazards of Compressed-Air Jets for Ventilating Gassy Mines. No. 6954: Dust Hazards and their Control in Mining. No. 6951: Progress Report 4 on Investigation of Detachable Rock-Drill Bits.

News OF THE INDUSTRY

Copper Production to Be Curtailed Here and Abroad

Phelps Dodge Corporation announces decrease in output by 20 per cent

THE HIGH PRICE OF COPPER during the year has apparently encouraged production to a point that copper stocks might become unwieldy if the high rate continued. On the last day of 1936 the price rose to 12c., Connecticut Valley, and around the first of October this year it was close to the same level. The intervening months, however, disclose a sharp rise to 17c., which took place on the last day of March. This high for the movement was maintained for only five days, then it dropped to 16c., where it remained only two days, April 6 and 7. The next drop was to 15½c., where the market was quiet for ten days. Another cent decline came on April 20, to 14½c., where it remained up to April 28. From the following day up until Sept. 24 it stayed at 14c., when on that day copper was sold at 13¼c. Thirteen cent copper was established on Sept. 27, and on the 29th it dropped to 12c.

Most domestic producers were enthusiastic about the price situation, as this encouraged a large buying movement by consumers in the last quarter of 1936 and earlier in the current year, and fortified themselves with large purchases against higher prices and threats of labor strikes, in the assurance that they would have sufficient metal on hand in view of the rising trend of industrial recovery. Consequently a very large tonnage of copper was bought at a price much below the higher prices named this year. In some cases it is believed consumers bought enough copper to last the remainder of the year. As the statistics below indicate, deliveries in March and April were very high, which reduced U. S. stocks of copper in April to 99,576 tons, from 142,374 at the beginning of the year. To make up this deficiency in stocks producers have, therefore, been operating at capacity, marginal producers have also been increasing their output, and some properties closed for several years have been reopened. If the present rate of production were to be continued, it is feared there is a possibility of copper stocks becoming unwieldy, threatening the price structure.

The first announcement of curtailment was made by the Phelps Dodge Corporation on Sept. 29. Output by that producer will be reduced by 20 per cent beginning Oct. 1 at all its copper properties. The work, involving an expenditure of $28,000,000, near Morenci, Ariz., on the Clay orebody, however, will not be affected, as plans for development will continue. Some influence might be exerted on the so-called marginal producers to automatically curtail production in view of the recent price decline, but this is difficult to determine, as metallurgical improvements and equipment have contributed to lower operating costs since 1929.

The table below shows the rapid rise in production since May, with a corresponding decline in apparent consumption, which has influenced a rise in domestic stocks. Present stocks of 123,484 tons at the end of August may be considered as about two months' supply at present average rate of deliveries, around 65,000 tons per month. The unknown quantity of copper that makes up the invisible supply has naturally increased, but figures are not available. Therefore, in view of the general doubtful trend of business for the last quarter and the lack of buying interest of copper consumers, some in the industry view curtailment at this time as a healthy move, that will guard against uncontrolled developments in price movements during the next few months.

A similar position has been taken by the copper producers abroad. They announced on Oct. 1 that their rate of operations will be at 105 per cent of total capacity, effective toward the close of November. The decrease in apparent consumption and increase of stocks abroad since May appear consistent with the direction of these two positions in this country, in the same time interval.

Copper Statistics of United States and Foreign Production and Apparent Consumption

(Copper Institute, Short Tons)

	Production, Blister					Production, Refined			Deliveries (Apparent Consumption)			Stocks, Refined		
	U. S. Mine	U. S. Scrap	Foreign Mine	Foreign Scrap	Total	U. S.	Foreign	Total	U. S.	Foreign	World Total	U. S.	Foreign	Total
December, 1934	.....	.....	.....	.....	122,400	.....	.....	.....	.....	.....	113,750	.....	.....	487,750
December, 1935	.....	.....	.....	.....	134,544	.....	.....	141,700	.....	.....	132,588	231,415	253,913	485,328
January, 1936	43,833	13,454	67,800	9,780	134,867	56,767	74,617	131,384	52,663	74,117	126,780	232,865	257,067	489,932
February, 1936	41,223	11,080	67,096	11,453	130,852	54,451	77,105	131,556	51,417	86,744	138,161	230,292	251,058	481,350
March, 1936	46,456	10,997	70,437	8,575	136,465	67,044	71,890	138,934	56,448	80,540	136,988	238,601	244,695	483,296
April, 1936	48,682	12,878	68,879	5,452	135,891	58,801	71,264	130,065	59,704	81,448	141,152	233,824	238,385	472,209
May, 1936	41,289	20,798	69,354	11,437	142,878	59,374	72,186	131,560	59,906	77,731	137,637	230,202	235,930	466,132
June, 1936	42,934	13,026	66,341	8,521	130,822	60,562	74,407	134,969	57,149	85,141	142,290	228,817	230,097	458,914
July, 1936	39,201	11,078	64,995	7,045	122,319	53,985	65,465	119,450	59,807	86,235	146,042	218,705	213,617	432,322
August, 1936	43,200	8,761	70,308	8,540	130,809	55,410	73,220	128,630	64,140	91,236	155,376	205,736	199,898	405,634
September, 1936	58,290	8,138	63,457	7,433	137,318	62,655	70,110	132,765	75,892	82,783	158,675	188,719	191,008	379,727
October, 1936	62,603	9,597	74,178	7,962	154,340	72,895	77,776	150,671	75,919	97,716	173,635	178,018	179,004	357,022
November, 1936	63,491	10,762	84,697	10,268	169,218	70,352	89,074	159,426	67,379	95,811	163,190	171,291	181,967	353,258
December, 1936	60,406	9,250	88,530	12,932	171,118	78,853	84,130	162,983	82,409	79,300	161,709	161,068	192,230	353,298
January, 1937	62,254	12,906	98,722	8,668	182,550	68,097	96,851	164,948	80,812	101,408	182,220	142,374	193,677	336,051
February, 1937	62,629	9,240	100,070	13,860	185,799	71,233	101,680	172,913	74,610	106,229	180,839	136,121	192,048	328,169
March, 1937	69,640	21,215	106,150	7,150	204,155	83,676	107,330	191,006	94,830	115,912	210,742	121,448	186,983	308,431
April, 1937	67,235	27,667	110,596	10,242	215,740	83,178	108,631	191,809	95,884	120,993	216,877	99,576	183,787	283,363
May, 1937	72,580	15,567	112,048	8,911	209,106	95,265	108,875	204,140	81,336	114,719	196,055	108,585	182,863	291,448
June, 1937	73,610	16,100	107,638	10,567	207,915	86,016	113,983	199,999	77,725	113,277	191,002	111,020	189,425	300,445
July, 1937	73,627	11,597	92,803	11,818	189,845	79,611	113,660	193,271	67,356	113,245	180,601	117,741	195,374	313,115
August, 1937	77,448	13,780	96,093	11,390	198,711	80,135	105,545	185,680	68,019	102,165	170,184	123,484	205,127	328,611

California

Rehabilitation of Copper Mine in Shasta County

United States Smelting, Refining & Mining Company commences work that may lead to opening of copper producer—Milling operations started at Rosencranz Mine

▶ It is understood that the United States Smelting, Refining & Mining Company has commenced rehabilitation and development work with a view of reopening its copper properties near Kennett, Shasta County. About 30 men will be employed as development gets under way, and reconditioning of the 4½-mile road from Kennett and erection of quarters for men are in progress now, to be followed by underground exploration. The work is directed by E. P. Jeanes, superintendent.

▶ Milling operations have been started at the Rosencranz mine, near Garden Valley, where Lode Development Company, of which Charles H. Brown is superintendent, recently completed a 100-ton flotation plant. Ore for the mill is obtained from the 130 and 250 levels, and preparations are under way to deepen the main shaft another 100 ft. Mill equipment includes a ball mill with classifier, a jig, five flotation cells, and a filter. Concentrates are shipped to the Selby smelter.

▶ Gold Exploration Mining Company, a subsidiary of Tintic Standard Mining Company, of Utah, has closed down the Blue Point gravel mine, at Smartville, after several years of operation. Failure to encounter pay gravel in the channel under development is the chief reason for the shutdown.

▶ Advices from Randsburg, Kern County, state that the Million Stamp Mining Company is planning to install a 50-ton ball mill and cyanide plant at the Million Stamp mine, near Kernville, now operated under bond and lease from the owners, J. C. Howe and Dick Weed. The large low-grade orebody said to be available for mining is to be exploited by glory-hole methods. Operations are directed by F. D. Burns, manager.

▶ Production of the Lava Cap Gold Mining Corporation for the first five months of 1937 amounted to $559,861, with an operating expense of $347,232, leaving profits, before charges and taxes, of about $212,629. The company operates the Banner and Central mines, near Nevada City. At the Central mine the new orebody opened up early this year on the 1,800 level has been encountered on the 1,400 and 2,000 levels and its limits have not been determined. The orebody is said to be 470 ft. long and about 30 in. wide, averaging $35 per ton at the discovery point, on the 1,800 level. Current ore reserves are estimated at between 200,000 and 300,000 tons. The dividend of 3c. paid June 30 brings the total disbursement since September, 1936, to 10c. per share. At the mine a new ore bin, a 90-ft. headframe, and a new double-drum hoist designed to operate to a depth of 4,000 ft. have been installed recently. The mill is treating 300 tons of ore a day, and about 300 men are employed at the property under the direction of Otto E. Schiffner, general manager.

▶ Burm-Ball Mining Company, John Burmeister, president, placed in operation the new 100-ton flotation mill completed recently at its Sisley Ranch property, about 5 miles west of Auburn, Placer County. The mine is opened by a two-compartment shaft 520 ft. deep served by a 100-hp. Taylor Iron Works hoist. An oreshoot 600 ft. long and 2 ft. wide, averaging $20 per ton in gold with some silver, is available for mining. Operating personnel includes H. W. Benson, accountant; Ed Lynn, mine superintendent; H. M. Lewers, mill superintendent; J. Monohart, chief electrician; and E. J. Kinsinger, secretary and treasurer of the company, who is in charge of assaying. The company also owns and operates the Original Bullfrog mine, at Bullfrog, Nev.

▶ In the Grass Valley mining district the Campbell-Grass Valley Mining Company, G. W. Worthington, manager, has started the 50-ton milling plant erected recently at the Norambagua mine, and Sierra Vista Mines, Inc., operating the Mistletoe mine, is reported to have ordered equipment for a 50-ton flotation plant. The company is headed by E. P. Glick.

▶ Development work at the Spring Hill mine, Grass Valley, is continuing, with the 100-ton mill being operated on a one-shift basis. Underground work completed recently includes the sinking of a winze from the 1,100-ft. level to the 1,250-ft. level and driving of a series of raises into ore which is said to compare favorably with that developed previously. Spring Hill Gold Mines, Inc., controlled by D. E. McLaughlin and S. M. Marshall, of San Francisco, owns and operates the property.

View of new cyanide leaching plant at Idaho Maryland Mines Corporation, at Grass Valley, Calif. The mill treats sands separated from flotation tailings and has a capacity of 360 tons a day

Montana

Rains and Snows Relieve Water Shortage

Operations pick up as hydro-electric power supply is increased—East Helena zinc plant reopened

▶ During the past month rearrangements of power consumption have permitted the resumption of several of the units closed down during August because of power shortage. Copper refining may now be said to be back to capacity, and late in the month the zinc plant at East Helena was reopened. The Butte Street Railway, by ruling of a State Commission, was permitted to go out of service and has been supplanted by a bus system. Heavy rains and snows in late September point to a further improvement of this situation in the near future.

▶ Walter J. Birkel, representing a group of stockholders in the defunct Glengary Company, has purchased the property at redemption at sheriff's sale for $16,291. There has been no report as to the plans in mind, but it is recalled that the Glengary mine was the scene of extensive developments in former years.

▶ The new cyanide plant completed at the Broadway mine early this month has since been operated on development ore and dump material. The extensive development program which has been in progress for several months has been very successful. Also, the shaft has been extended 60 ft. below the former 650 level, and crosscut connections to the vein, with drifting toward the main oreshoot, have disclosed an increased length of the shoot at the new level. The operation is a unit of the Taylor, Nelson, Knapp Corporation, which also operates the Two Percent Mine, at Philipsburg.

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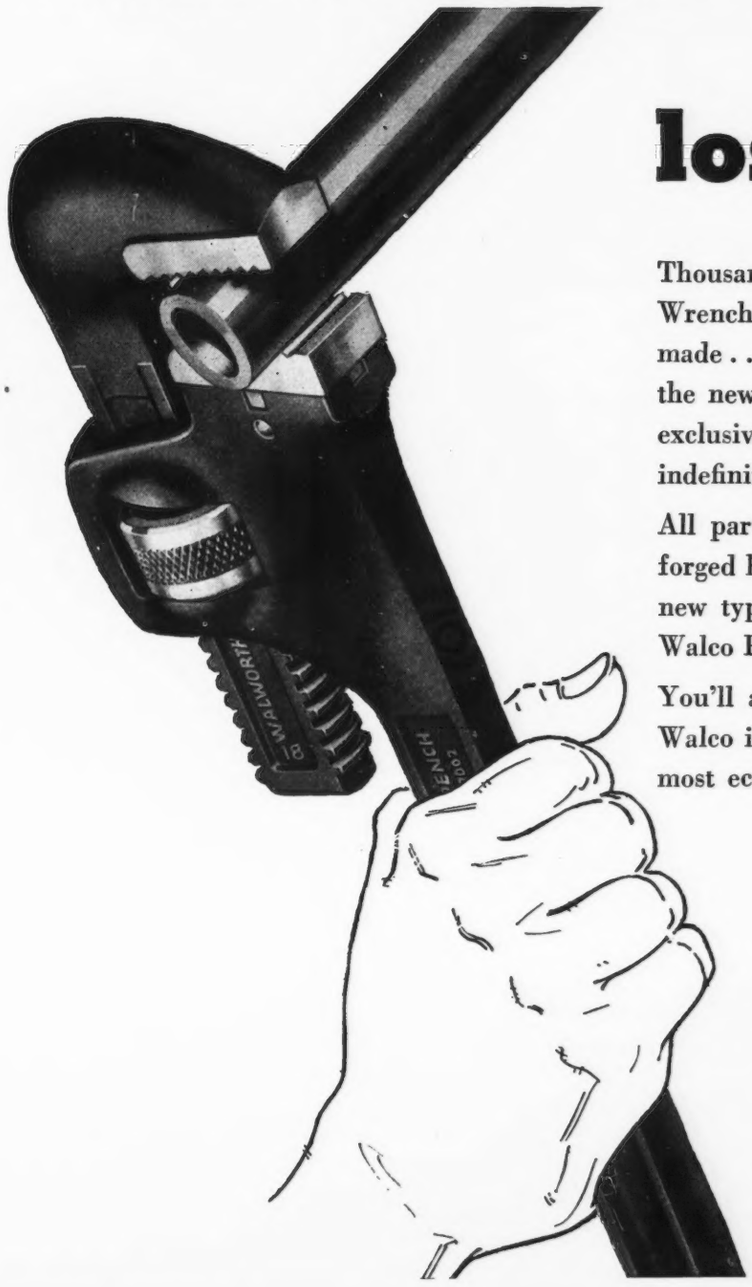

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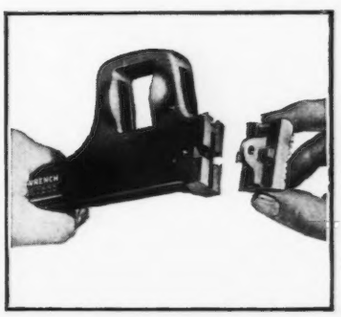

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Idaho

Vein Extension Found in Silver Crescent

Silver content similar to that found in upper levels—Old workings of Minnie Moore mine being drained of water through drill holes

▶ A vein, on the Silver Crescent, on Moon Creek near Kellogg, was recently reported found, in a crosscut south from the Dickens shaft, to be about 20 ft. wide, containing silver content similar to that found in drifts 600 ft. above, according to Ross Roundy, manager, who believes the vein is sufficiently prospected to determine its course. The management will continue the crosscut to the south to reach the south vein, a distance estimated at about 200 ft., judged by the dip of the vein 600 ft. above. The south vein carries more lead and zinc than the No. 1, which contains a higher content of silver. Stewart Campbell, former Idaho mine inspector, who has acted as consulting engineer at the Silver Crescent, after sampling the ore where the vein was encountered, and before drifting, reports the footwall zone yielded 15 to 200 oz. in silver, $1.75 in gold, and some copper. This will give a high mill feed, and as the vein is wide, with ore along both walls, the tonnage will be adequate for extensive milling operations. The mill was built several years ago by W. L. Zeigler, Hecla mill superintendent, and is well adapted to treat the ores from both properties, now united in one consolidation, comprising more than 1,000 acres of ground at the head of Moon Creek.

▶ The labor disturbance at the Sunshine mine several weeks ago is occupying the attention of the Federal Labor Board in a hearing under way at the court house on charges filed by a local union affiliate of the CIO. Patrick H. McNally, of Casper, Wyo., is presiding as trial examiner. Appearing for the Labor Board are Attorneys Daniel Baker, of Seattle, and Paul F. Nachtman, of Washington, D. C. For the Sunshine company James A. Wayne, of Wallace, and Therrett Towles, of Spokane, are handling the case, with Charles E. Horning representing the Big Creek industrial union. Charles W. Hope, of Seattle, regional director of the National Labor Relations Board, on whose complaint the hearing was ordered, is also in attendance. Counsel for the Sunshine company has made the contention that the company is not engaged in interstate commerce and thus is not subject to the jurisdiction of the National Labor Relations Board. Examiner McNally overruled the contention. The company is charged in the complaint with being engaged in unfair labor practices, intimidation, and coercion.

▶ Four drill holes in a crosscut of the Minnie Moore mine recently tapped a watercourse from the old workings of the mine 400 ft. higher than the crosscut. The old workings have filled with water, but once this is drained, which is expected to be in 30 days, a pump will keep the crosscut and the older mine free, the normal flow being about 125 g.p.m., according to C. O. Dunlop, vice-president of the company. The four holes were driven so that the flow would be sufficient to keep the mine pumps busy and free the workings without much loss of time. As soon as the water is out of the way, crosscutting will be resumed to seek a lost portion of the vein.

▶ The Palisade property on the slope of Mount Baldy is the scene of much activity, according to Theodore Schmidt, president of the corporation. A road will be finished soon and machinery installed. Manager Schmidt states the drift on the vein is now in 315 ft., showing about 4 ft. of siderite, containing copper, silver, and lead.

▶ Officers of the Texas Mining Company, developing a group of claims at the head of East Eagle Creek, in the Coeur d'Alenes, report completion of a road to the property from East Eagle highway, and plans are now under way to carry forward an active program in the lower tunnel.

▶ Under a decision rendered by Federal Judge C. C. Cavanah, title to the Gullickson group of claims in the Big Creek area was quieted in favor of the present owners, the Sunshine Consolidated, after the court had found no evidence to substantiate the allegations of fraud against Dr. J. R. Bean, administrator of the Gullickson estate, and his attorney, Walter H. Hanson, and others cited in the complaint, including Lester Harrison, of Kellogg, who promoted the consolidation of a large area of ground in that district into the Sunshine Consolidated, taking in the Gullickson group as a part of this consolidation. This ground he acquired from the Sunshine Extension company and the handling of the property in the Gullickson estate down through its various stages was found by the court to have been open and clear throughout.

Colorado

Production at Sunnyside Mine 500 Tons Daily

Output of lead producer may be increased—Some operators solving problems of tailings disposal

▶ The Sunnyside Mining & Milling Company, at Eureka, is now mining and milling over 500 tons daily and expects to increase this tonnage to 1,000 tons. Mr. Fleming, mine superintendent, and Frank Stampfel, mill superintendent, expect to operate at full capacity all winter.

▶ The Gregory Bates Mining Company, in the Central City district, under the direction of Douglas M. Todd, general manager, has given up the use of stamps in its mill and recently installed a Marcy ball mill, and is employing the cyanide method of gold recovery. Present production is around 140 tons of ore per day, employing about 50 men. S. F. McCarroll is mill superintendent and H. Ewald mine superintendent.

▶ United Gilpin Corporation, under the supervision of R. G. Sullivan, general manager, is mining and milling about 150 tons of gold-silver ore per day. As soon as the tailings disposal problem is completely solved, production will be increased. Mr. Van Eman is mill superintendent and Ed. Burkhart is mine foreman.

▶ Utah Zinc Company has started active work opening three of the largest mines in the Silver Plume area: namely, the Terrible, the Mendota, and the Smuggler mines. The Terrible and the Mendota veins are two of the three master veins of the Terrible group that parallel one another about 500 ft. apart. The southwest end of the Mendota vein, known as the Smuggler, is well opened by tunnels and drifts. Mendota mine, on Sherman hill, can be worked continuously through the Victoria tunnel.

▶ Clear Creek Consolidated, at Dumont, is within 600 ft. of the Albro vein, its objective. Other operators in this district are active. The Kavern Company recently cut the Kavern vein and completed the 125-ft. tunnel. The Gold Leaf, operated by Ben Stanhope, has opened up some good ore. The company has completed the installation of a 150-ft. compressor and is ready for winter operations. Freeland mining company, operating in this area, has encountered good ore in the Lamartine mine; considerable cleaning-up and repair work is necessary, however, before the company will enter steady production.

▶ High up in the San Juan Mountains at Crede, the Commodore, the Amethyst, and two operators on the New York-Chance-Del Monte group are ready to supply a steady tonnage to the new mill now under construction. This mill will have a daily capacity of 150 tons. Considerable activity in this old gold and silver camp gives promise of steady operations throughout the winter.

▶ At Empire, Minnesota Mines, Inc., are constructing a dam on Crear Creek to retain the tailings from the 300-ton mill. This property is considered the largest producer in this territory at present. Mr. O'Dell, general manager, believes the substantial ore reserves will afford production for a long time. The mine and mill are high up in the mountains above Empire, and entirely accessible the year round.

▶ Beaver Creek Placer Corporation recently installed a floating-type gold dredge that is fed by a 2½-cu.yd., Northwest dragline with a 70-ft. boom. Under adverse digging conditions, with 15 per cent of material over 24 in., the dredge has been in successful operation, maintaining the rated capacity approximately 125 cu.yd. per hour. The dredge was manufactured by the Universal Dredge Manufacturing Company, of Denver.

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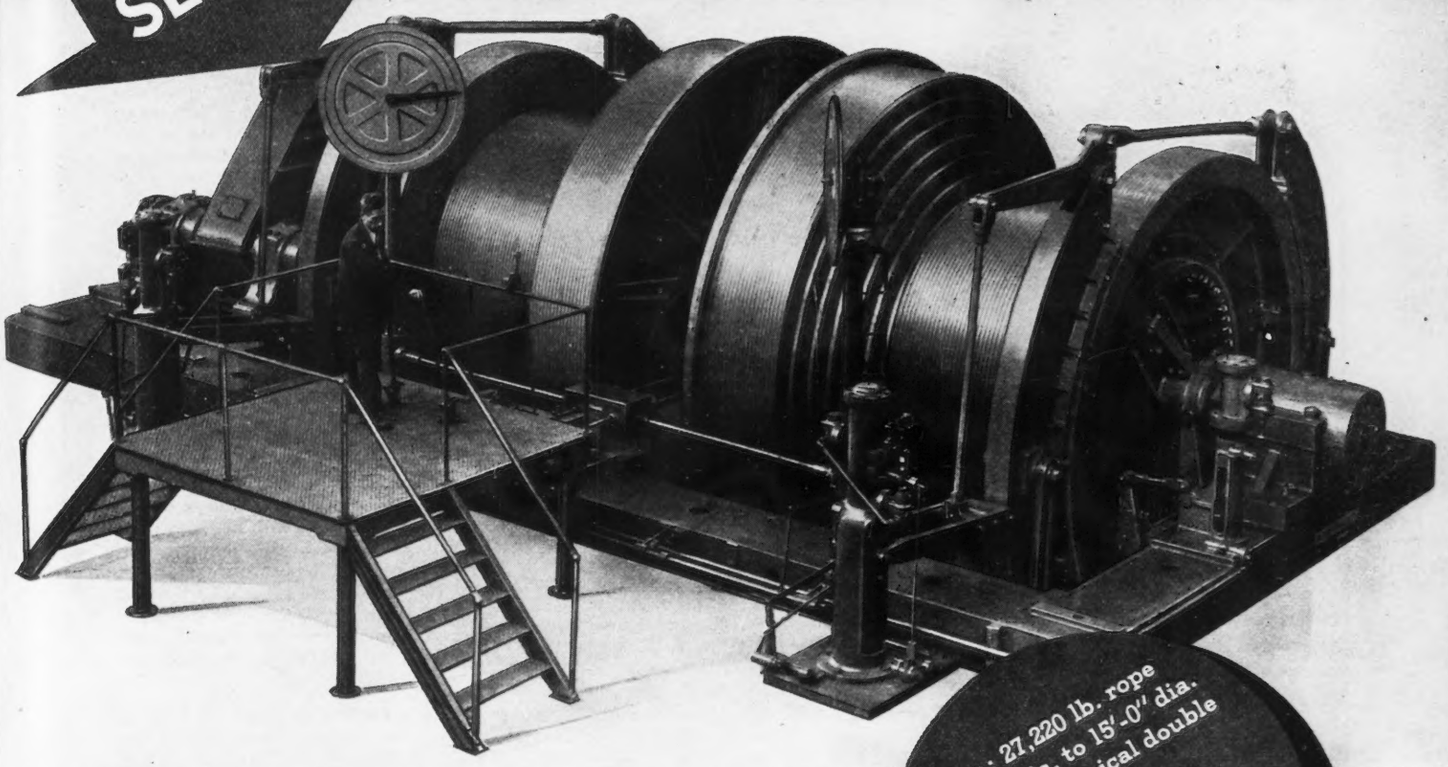
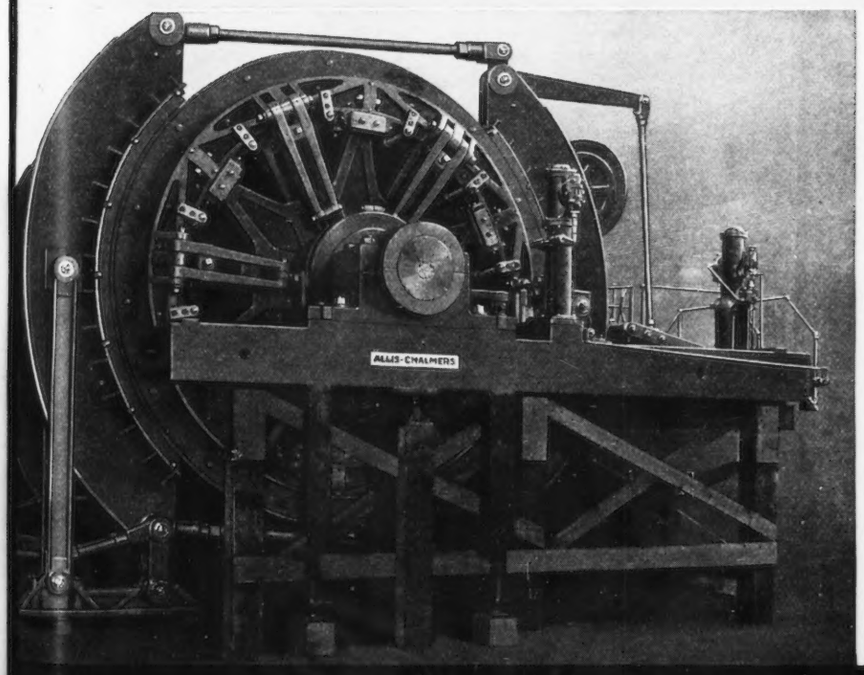


Above: 27,220 lb. rope pull 9'-0" dia. to 15'-0" dia. Bi-Cylindro-Conical double Drum Hoist.

Left: Double Drum Mine Hoist—50,000 lbs. rope pull from 4,500 ft. at 2250 fpm. maximum.



Allis-Chalmers builds mine hoists to solve every hoisting problem from that requiring a small friction or electric hoist to hoisting 50,000 lbs. or more a lift at 3000 fpm. Allis-Chalmers also builds electric drives and control for all sizes of hoists. ***Write for Bulletin 1830.***

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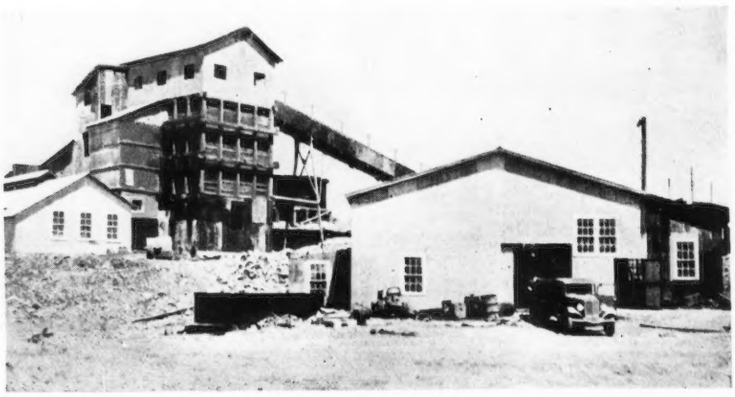


Cyanide plant of the Gold Standard Mines Corporation at Katherine, Arizona, which is treating 250 tons daily from its Portland, Minnie, Philadelphia, and Arabian properties. This mill has been in steady production for the past four years

Arizona

Encouraging Developments At Tom Reed Mine

Exploration on 300 level reveals prospects for greater ore reserves—Many operators add new equipments to increase production and improve metal recovery

▶ The Tom Reed mine, at Oatman, Mohave County, uncovered a lost segment of vein while drifting on the 300 level. When the Ben Harrison shaft was recently retimbered by the company, a station was cut at the 400 level. Previously there had been no station between the 300 and the 500-ft. levels. Present exploration of the new find indicates the existence of substantial tonnage of commercial ore. The Tom Reed company produced a million in gold in its last fiscal year, and prospects are that this record will be exceeded this year. The mill is treating a large tonnage of custom ores from adjoining properties in addition to the company's own mine production. Bemis Phelps is manager of the property, and Jack Zwinge is mine superintendent.

▶ The Miami Copper Company, Miami, is mining about 15,000 tons of copper ore daily. The plant has a capacity of 18,000 tons. A flotation and leaching process is used for the recovery of copper. About 1,360 men are on the payrolls, and all operations are under the direction of A. S. Winther, manager for the company.

▶ The Herron & Lester lease, on the Lake Superior and Arizona property at Superior, is mining about 60 tons of gold ore daily. The ground is leased from the Magma Copper Company. Thomas D. Herron is superintendent, and employs 26 men.

▶ Charles Elliott, of San Francisco, and associates, owners of the Cypress mine, in the Big Bug district near Mayer, have a development contract with the Gold Medal Mining Company, now operating the property. The ore contains gold, silver, and copper. Frank P. Leach, of Mayer, is superintendent in charge.

▶ A new Denver flotation unit has been installed by the American Kirkland Gold Mines, Inc., on its properties near Kirkland. This installation boosts the daily tonnage up to 75 tons. Electric power transmission lines have been extended to the mines. New headframes have been installed on the Beehive shafts No. 2 and 3 and new laboratory has been equipped. Twenty-five men are employed. The work is under the direction of Dr. Hugo A. Carl, general manager.

▶ The Arizona Copper & Chemical Company is working on some properties 110 miles north of Flagstaff. This property was located over 50 years ago and was exempted from the Navajo Indian reservation by order of President James A. Garfield. It has not been worked since 1917. The ore is said to average from 5 to 14 per cent copper. It occurs in Navajo sandstone.

▶ The Manta de Ore Mines, Inc., have added several large tanks to their leaching equipment on the Cyclopic mine, situated in the Gold Basin district 50 miles north of Kingman. The plant is handling about 100 tons daily. The open pit method is employed in mining operations and about 25 men are employed under the management of E. H. Crabtree, president of the company. The postoffice address of the company is Chloride, Ariz.

▶ Bunker Hill Arizona Mining Company has installed a 50-ton flotation plant at its mine in the Sombrero Butte district 30 miles north from Globe, in Gila County. The company's offices are in Seattle, Wash., and its officials report the probability of the installation of additional units. E. E. Zwicky is in charge of the installation. He has been associated with the Bunker Hill & Sullivan interests for a number of years and has just completed the installation of a flotation plant at the Deer Trail and Monitor mines, at Fruitland, Oregon.

▶ J. B. Johnson, of Glendale, Ariz., is developing the Mystery mine, in the Tip Top district, by sinking a shaft. The mine is under lease and option to Edward A. Eichstadt and J. E. Meyers. Mr. Eichstadt is superintending the work.

▶ Roy Williams, holding a lease on the Dean mine, in the Hualapai Mountains 14 miles east from Kingman, is making regular shipments of silver ore to the United States Smelting, Refining & Mining Company's reduction works at Midvale, Utah. Emil Nathan, of St. Louis, is owner of the property.

▶ The Belmont copper mine, near Superior, is under lease to Charles Smith, and is shipping approximately 300 tons of ore monthly. A crew of twelve men is employed.

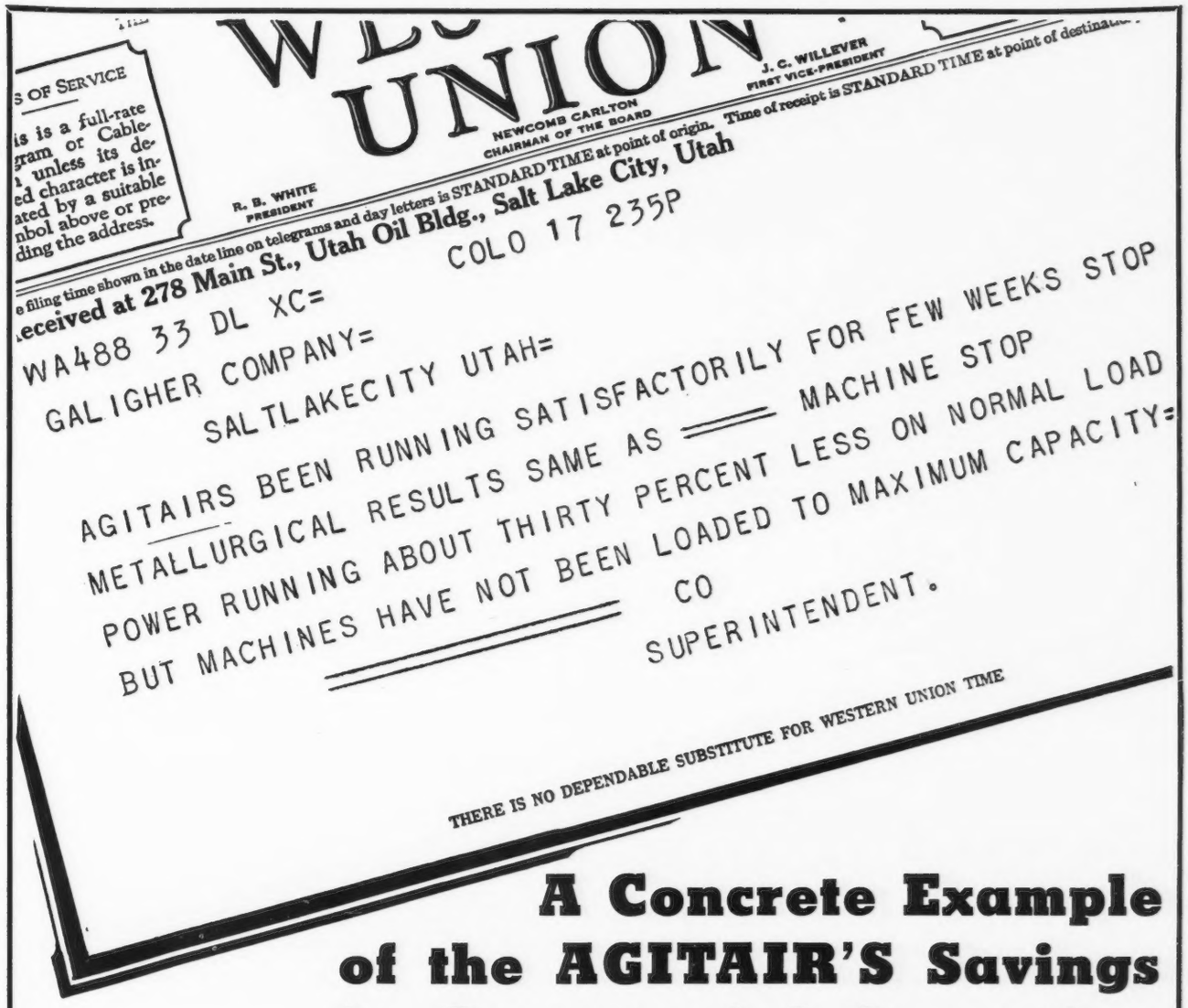
▶ St. John Gold & Copper Company, of Cleator, has sunk an incline shaft to a depth of 310 ft. and is now drifting on the vain in opposite directions. It is stated that approximately 50,000 tons of ore have been blocked out and that as soon as an additional 50,000 tons are blocked, exploitation will begin. Present work is on the high-grade vein, but there is a vertical deposit, said to range from 135 to 300 ft. in width, containing low-grade gold ore. Exploration of this deposit will be started soon. John Slak, of Cleator, is president and general manager.

▶ Diamond drilling is under way at the Young Mine, in the Red Picacho district near Morristown, Yavapai County. The property has been opened by shaft and tunnel to a depth of 280 ft., with about 500 ft. of drifting. About 10 tons of ore daily is being produced, containing gold, silver, and copper. F. R. Vihel, of 1417 East McDowell Road, Phoenix, is superintendent.

▶ The Consolidated Gold Mines Company, Ltd., of Dos Cabezos, Ariz., is enlarging its plant to 100 tons, daily capacity. The property is opened by a 1,000-ft. tunnel and developed by 9,000 ft. of mine workings. C. W. Gabrielson, Box 279, Bisbee, is president of the company. A. B. Wadleigh is general superintendent.

The Lalor Foundation

ON OCT. 10, the Lalor Foundation announced a program of five fellowship awards of $2,500 each, which will be granted for the academic year 1938-39. Applications are to be in the hands of Secretary Lalor Burdick by Dec. 31, 1937, and appointments will be made in February, 1938. The awards will be for research work in various fields of chemistry and related sciences. Appointment is made to residents of the United States and, except in unusual cases the minimum requirement for consideration for the award will be the attainment of the Ph.D. degree, or its equivalent, prior to the submission of application.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NEWS FROM Washington

By Special Correspondent

BUSINESS TROUBLES during September really worried Washington. Recovery appeared to be at a standstill. Business indexes showed a stalemate in the game of profit-making versus unemployment. Something had to be done. Four important actions were taken:

(1) Regional Reserve banks lowered the rediscount rates. This was intended to make additional funds easily available to commercial bankers for financing crop movement, new business ventures, and security issues.

(2) Sterilized gold was released to the extent of $300,000,000, further to reestablish bank reserves and, as the Federal Reserve Board stated, to "contribute to the continuation of the easy credit conditions."

(3) Open-market purchases were undertaken aggressively by the Reserve Board to absorb the Government securities being sold by banks and others.

(4) The definition of commercial paper eligible for rediscount was widened. This is merely another technic in enlarging the credit base for "easy money."

One needs no more proof than these four items to be convinced that the Administration was really worried about business and bond-market trends. Nominally this feeling did not arise from stock-market prices; but actually the sharp drop in equity securities was noted with concern. Such a movement tended to aggravate business jitters and was likely to interrupt the reemployment program, if not actually reverse business trends.

Silicosis Studies

ALTHOUGH legislation regulating industry in which dust exposure might cause silicosis was not passed by Congress, the Federal agencies interested continue to press their technical and medical studies. The prospect for such legislation next year remains altogether uncertain, but this does not influence the activities of either the Bureau of Mines or the Public Health Service.

A recent bulletin of the Bureau gives a very comprehensive factual summary under the title "Review of Literature on Effects of Breathing Dusts, With Special Reference to Silicosis." The Bureau is also continuing its tests of dust respirators in order that purchasers may have independent official appraisal with various types marketed. Thus far thirteen types of respirators have been approved. (Information Circular 6952.)

The Bureau is continuing its study of a new X-ray method for determining the free silica content of dust. Most of the methods previously used are either tedious or expensive and many are not dependable. In a recent statement in the Far West the Bureau expresses the hope that early next year this new method may have been sufficiently studied to warrant a formal recommendation.

It is expected that the Public Health Service will have primary responsibility for medical and hygienic measures involved in any Federal program adopted.

A new measure is proposed by Representative O'Connell, of Montana, to provide Federal aid to the states which set up agencies to handle claims for compensation or to assist in treatment or medical control methods. At present 21 states recognize such occupational diseases under their accident compensation laws. It is expected that more such legislation will promptly follow if any of the Federal bills now under study are enacted.

LABOR BATTLES

METAL MINING is being smeared in Washington by the careless talk and over-broad interpretion about certain labor battles which have centered in troubled coal-mine areas. The Senate civil liberties committee, under the chairmanship of Senator La Follette, of Wisconsin, has furnished the sounding board for those who have criticized coal-mining companies and charged terrorism at Harlan County, Kentucky, and elsewhere. The renewal of the La Follette committee hearings in September, after a four months' interval, causes the present concern. Unfortunately for all other mining industry, there appears to be little distinction made between those few and limited areas where battling with force has undoubtedly occurred and the other numerous peaceful, well-behaved mining communities.

THE INDUSTRIES which are affected could well ignore all of this trouble were it not for the indirect effect on legislation which is feared next winter. At that time Congressmen will be asked to pass on many phases of the wage-hour question. Spokesmen for metal and non-metallic mining will then find it necessary to build up a discriminating consideration so that these "atrocities" will not be magnified to a point that will obscure the real practices of the majority of the industry. Adequate facts are available, and it is expected that members of both houses of Congress who represent Western states will be disposed to point out that their constituency is not involved.

Mine Budgets

MINING and mineral industry executives are perhaps no differently affected by these security and fiscal problems than are other business men. But some of the corporate groups in the mining industry are distinctly more vulnerable, because of the wider swings in buying activity which come quickly on the heels of jittery or boom thinking.

Fundamentally, every division of business is facing a set of new cost problems. Strikes, higher labor costs, new and burdensome taxes, closer regulation by Government, possible shortage of raw materials affected by world wars, and a dozen other cost factors can be cited. Reduced to the simplest terms, Washington believes the explanation may be that the magnitude of business transacted during the next year or two will probably not decline, but the opportunity for profit is being substantially lessened.

Mining executives will be glad to note that this uptrend in costs worries Washington. It should, because only profitable business can be generously taxed. But, worried or not, the Administration gives no evidence of any intention to relax its pressure on business for those reforms and social advances which, at least indirectly, have initiated the market and business uncertainty.

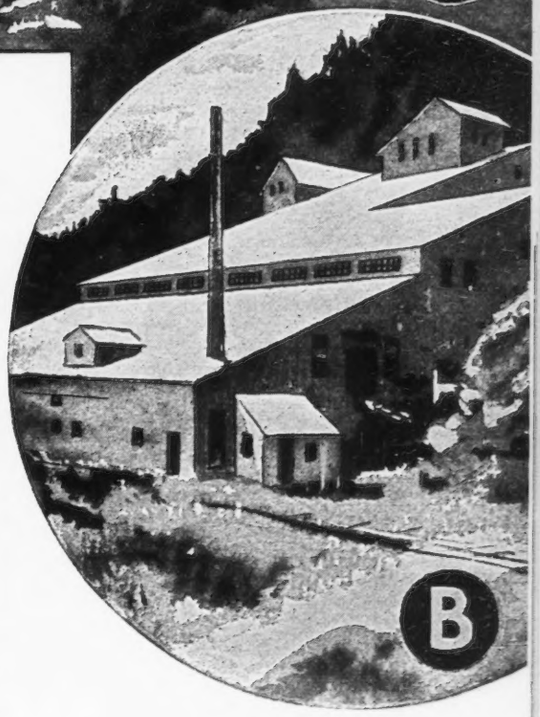
Treasury Influences

TAX REVISION PLANS still contemplate beginning of hearings before the Congressional committee in November. But there is increasing doubt in Washington whether a genuine complete overhaul of present tax laws can be achieved. The early promise of the President and Treasury to this effect somewhat weakens, as Congressmen indicate clearly their desire to follow the line of lesser resistance in "revision by amendment."

But neither faction in the argument as to *how* to revise the tax law gives any evidence of working vigorously for lower taxes. Cure of the business ills discussed in the foregoing by economy and budget balancing is not expected. Reserve Board methods will have to suffice, unless more critical political factors enter. The latter result is likely only if violent inflationary or new unemployment factors become significant and likely to change votes.

One thing that has surprised some Washington commentators is that business did not spurt forward when the pressure of new regulative threats was relieved on the adjournment of Congress. This observation probably did not surprise any one who believes that fear of the Executive, rather than fear

FOR A OR B OR C: BEAR BRAND XANTHATES



These illustrations picture three mills with three widely different flotation problems. One needs a potent collector for bulk flotation. Another needs reagents for selective flotation on a highly complex ore. The third is in between these extremes. They all present examples of actual mills — *all using Bear Brand Xanthates.*

Some mills use one Bear Xanthate; others use two or more. There are six of them, to help solve the problems of every flotation man, on any non-ferrous ore. *And today Bear Xanthates are being used on virtually every conceivable type of non-ferrous ore.* How about your ore? We will be glad to send samples for test runs.

Z-3 Potassium Xanthate
Z-4 Sodium Xanthate
Z-8 Butyl Xanthate

Z-5 Amyl Xanthate and
Z-6 Pentasol Amyl Xanthate
(Both from Sharples Amyl Alcohol)

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A This illustration represents an actual mill floating a heavy tonnage of sulphide copper ore. Bulk flotation is employed, needing a thorough but inexpensive collector. It's a Bear Xanthate!

B Gold ore needs the most potent collector. Some selective flotation may also be used—as in the mill this view represents. The job is done by Bear Brand Pentasol Xanthate.

C Copper, nickel, lead, zinc are all recovered by the property this illustration represents. Highly complex ore; needs both a powerful collector and a highly efficient selective reagent. Two Bear Brand Xanthates do the job.

of the Congress, underlies the business man's nervousness when he hears anything new from the Capital City.

TVA Power Sales

LATE IN AUGUST the Tennessee Valley Authority announced the sixth important contract which it has made for the sale of power to large industrial customers. This contract was with Electric Metallurgical Company for energy supply initially of 8,000 kw. and ranging up to a potential 40,000 kw. by 1941 should the company wish to use that much. Both primary (continuous) power and run-of-stream secondary power will be supplied.

The TVA estimates that the annual value of this energy sale by the Authority will be more than $750,000 if the maximum amount under contract is taken. With the five other large industrial contracts, its gross income by 1941 may be as much as $4,300,000, the Authority forecasts. In general, the power costs will range from 2 to 3 mills, depending on the proportion of primary energy used.

It is of importance to mineral industries to note that the bulk of these power requirements are for companies which will process minerals to make metal or chemical products. In some cases national distribution of these products is expected, of phosphate rock derivatives, for example; but in other cases only regional requirements for the products will be met by these Valley developments.

Pollution Studies Started

ADVOCATES of new Federal regulations to prevent stream pollution have arranged for aggressive work of this sort to start immediately on the Ohio River and its tributaries. The Engineer Corps of the Army is directed by Congress "to ascertain what pollutive substances are being deposited, directly or indirectly, therein and the sources and extent of such deposits, and with a view to determining the most feasible method of correcting and eliminating the pollution of these streams."

In order that this investigation fit in with the more elaborate studies contemplated to begin next year (when the Vinson-Barkley bill is law), the War Department investigators are instructed to work in cooperation with the Public Health Service, under which the complete program to be provided by the Barkley-Vinson bill will be carried out. The costs of the survey, even the work done by P. H. S., will be paid for from river and harbor survey moneys.

It is not expected that mining and mineral enterprises will be affected immediately by these Ohio Valley studies, but the policies there formulated and the technical conclusions reached will govern work elsewhere that will have direct influence on mining waste disposal. Sealing of abandoned mine properties to prevent acid water drainage into streams is one of the major questions to be considered. This work on the Ohio relates primarily to coal mines, but has real policy significance for those who wish to appraise probable future rulings of Federal officials on metal mining.

SILVER BONUS ENDS?

THE PEGGED price at which the Government purchases domestic virgin silver expires at midnight, Dec. 31. However, the Treasury has announced that any silver mined prior to that time will be purchased by the Government at special price of 77c. plus, even though delivery is delayed into the new year. Renewal of this silver bonus, which amounts to a 75 per cent bounty under prevailing market conditions, is expected. In fact some Washingtonians think that the Treasury announcement regarding delay in deliveries was merely notice to silver producers and their legislative friends that they should get busy to arrange the extension of this regulation. In a pre-election year it is unbelievable that the President will not make some extension, but question is raised as to whether a bonus of 33c. on a commodity selling in the world market at 44c. should be necessary. That is "a very generous bounty," according to critics.

ARGUMENT for continued silver purchases is based on the law which requires the Treasury to continue increasing silver stocks up to the prescribed ratio to gold, but those who would like to save the Treasury money argue that the buying of silver for monetary reserve is not dependent on any such bonus prices. They state, probably rightly, that this high price does not accelerate significantly the speed at which the Treasury can secure silver. But this arguing is an incidental matter; the decision regarding the price in 1938 will be made on political, not economic, conditions.

INTERNATIONAL complications are also involved in the consideration of a suitable price to be paid for silver next year. Uncle Sam does not wish to make himself a goat in this matter by maintaining an unduly high silver price. To do so would merely add to the cost of accumulating the additional metallic reserve which the law prescribes. Some agreement between Washington and London will be necessary before the President finally promulgates his next year's silver price. Economists and officials are even hoping that a more favorable monetary agreement may be achieved, with silver as one of the considerations. Naturally, President Roosevelt will hold back on his decision regarding the silver price in order to use this as fully as possible in the trading which is going on with British and French financial leaders.

Idaho Phosphate

ENGINEERS of the Tennessee Valley Authority have been working with representatives of Idaho, Montana, and Utah in a reconnaissance to determine what sort of phosphate processing plant should be built in this Western territory (*E&MJ* Sept., p 72.) The conferences during September were intended to fix a preliminary basis for translating the results to date at Muscle Shoals into a plan applicable to the Inter-mountain phosphate problem.

Funds for such venture are not immediately available. Senator Pope would like to have the Federal Government pay the bill. The TVA probably does not have spare cash, perhaps not the authority, to do this job out of its own Valley area. Relief funds will probably be sought. If the President does not approve such allotments, as seems likely, then state appropriations will be asked.

The whole plan will, of course, contemplate a publicly sponsored enterprise in competition with present mineral-industry plants which use byproduct acid from smelters to make phosphate fertilizer. The principal basis on which appeal to New Dealers can be made is that such plant should afford a fine outlet for the contemplated surpluses of power to be developed in this area remote from customer industry.

British Trade Deal

A RECIPROCAL trade agreement with Great Britain moved measurably closer to reality in late September. Outstanding evidence of this is found in the public statements of British Foreign Secretary Eden. That statesman even went so far as to declare the willingness of His Majesty's Government to negotiate a trade agreement which may place the United States almost in the status of a Dominion so far as tariff preference is concerned.

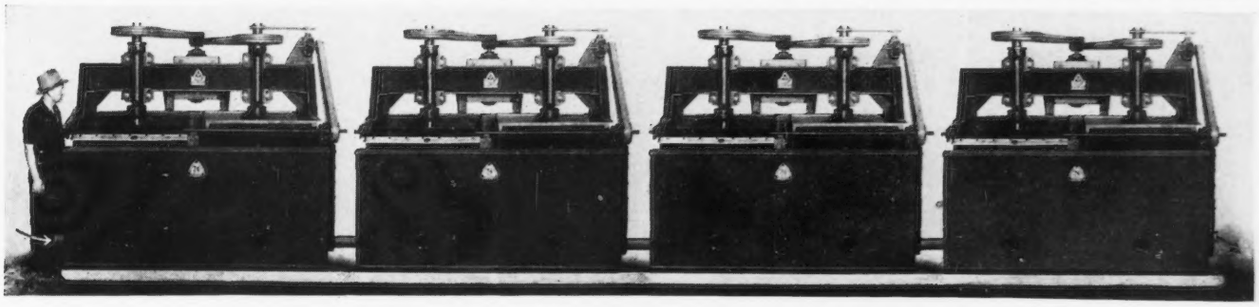
Washington is studying these matters with the greatest of care. Most of the necessary statistical matter has been made available. It will not surprise close observers in the Capital if the State Department makes formal announcement during the fall of its "intention to negotiate" with Britain. And these negotiations may well encompass almost the complete sweep of industrial ores and minerals, since either United States or Britain is concerned with every major division of the American tariff law.

Washington believes that a number of the dominions are finding that the famous Ottawa agreement regarding Empire preference on goods is undoubtedly restrictive of colonial trade. They are almost ready to place the United States on an equality with themselves in tariff preference, so it is commonly said. Definite return toward the fundamental free-trade policy of Britain would, the dominions believe, strengthen their position and benefit their business relations with the United States.

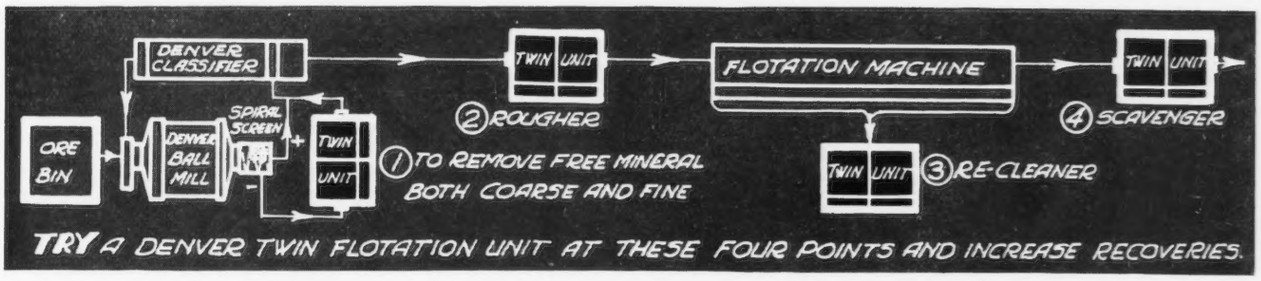
Metal and mineral industries will note this with interest, and with some concern.

Coupled together like a streamline train

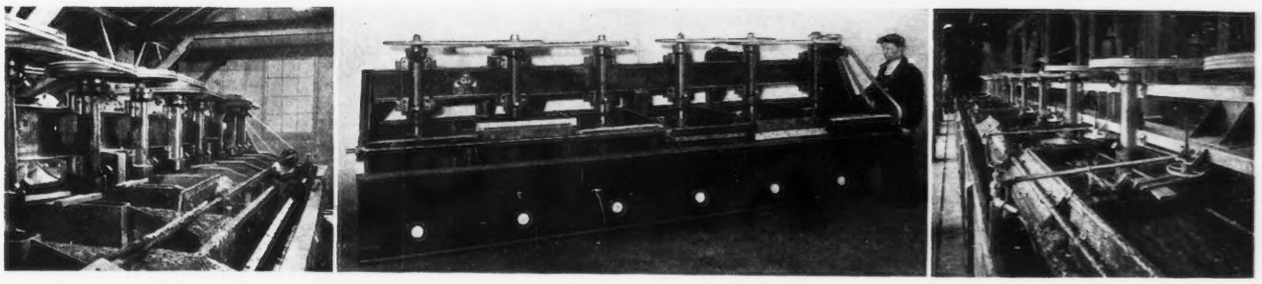
DENVER TWIN FLOTATION CELLS ARE THE LAST WORD IN ECONOMY



AND FLEXIBILITY ☆ NOTE FLOWSHEET SIMPLICITY ☆ IDEAL FOR



SMALL MILLS ☆ THESE CELLS HAVE THE DENVER "SUB-A" (FAHREN-



WALD) FLOTATION PRINCIPLE ☆ STANDARD THE WORLD OVER

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NEW YORK CITY, NEW YORK: 50 Church Street
SAN FRANCISCO, CALIF.: 503 Market Street
EL PASO, TEXAS: Room 1025, Mills Building
MEXICO, D.F.: Baker Bldg., 16 de Septiembre 58

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

TORONTO, ONTARIO: 45 Richmond Street West
VANCOUVER, B.C.: Pacific Coast Fire Building
LONDON, ENGLAND: 840 Salisbury House, E.C.2
JOHANNESBURG, SO. AFRICA: Bon Accord House
MELBOURNE, AUSTRALIA: 360 Collins Street

DENVER EQUIPMENT COMPANY

Utah

Ohio Copper Company Starts 1,000-Ton Mill

New plant at Lark treating copper tailings —Snyder Mines, Inc., also starts large-capacity mill near Mercur, where other mining projects are under way—New 600-ton mill will be erected at Ophir

▶ At Lark, near Bingham, the Ohio Copper Company has put its milling plant in operation, the installation costing $70,000, for the treatment of a tailings dump containing about 5,000,000 tons. The tailings are sluiced into a 500 ft. flume by a hydraulic giant. Pressure is maintained at 100 lb. to the square inch and water is used at the rate of 250 g.p.m. The slime is collected in a concrete sump and pumped in an 8-in. pipe line to the 1,000-ton flotation mill. Agitators dilute the slime to flotation density. Sulphuric acid and iron scrap are added to cause precipitation of the soluble copper. The overflow, containing the precipitated copper and the sulphides, is sent to flotation machines. On a 24-hour basis, employing 20 men, Percy H. Kittle, president of the Ohio Copper Company, reports that the mill should produce from 6,500 to 7,000 lb. of copper precipitate daily and 15 to 16 tons of concentrate, averaging 22 to 23 per cent copper.

▶ The Mercur mill has been moved by Snyder Mines, Inc., from Manning, a distance of 7 miles from the gold camp, where it had been operated for several years. Water supply was assured by the development of two wells at the mouth of Mercur Canyon. The water is pumped through a six-inch pipeline a distance of 7 miles, overcoming an altitude of 1,200 feet. The capacity of the Mercur plant is 1,000 tons. Placed near the Ingersoll shaft on the Golden Gate property, the plant is in the center of an area estimated to contain 3,000,000 tons of tailings.

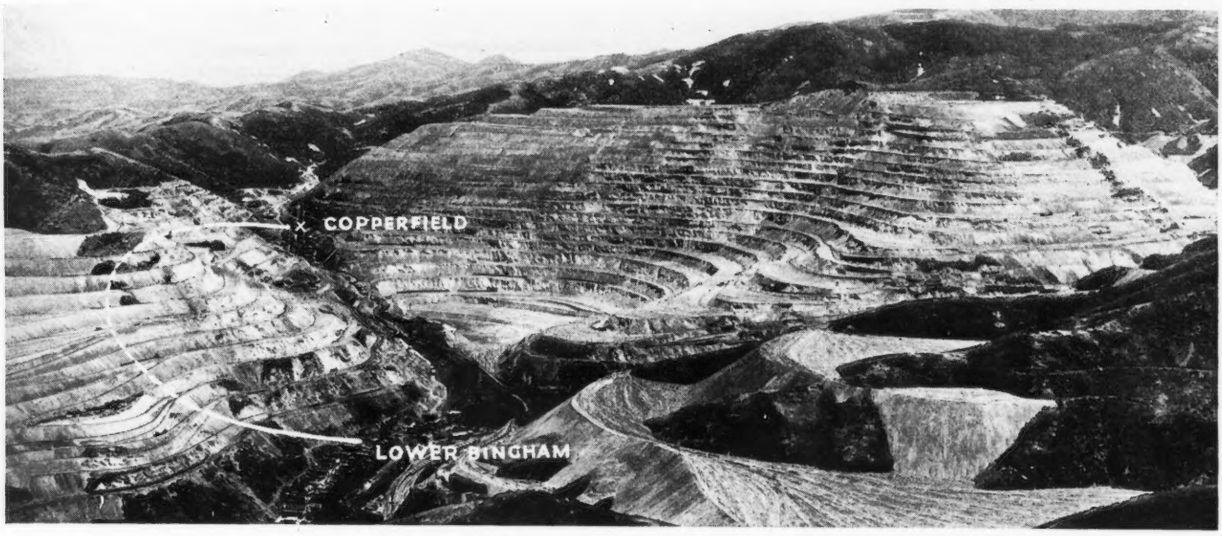
▶ J. O. Elton, manager of the International Smelting Company, announced on Sept. 25 that the company will build a 600-ton flotation plant at the old camp of Ophir, 60 miles southwest of Salt Lake City, to treat the tailings dump of the Ophir Hill property, formerly owned and operated by the late Senator W. A. Clark, of Montana. Ryberg Brothers, Salt Lake City contractors, have been awarded the contract for construction of the new plant. In its production of close to $25,000,000 over a thirty-year period, the mill at the Ophir Hill, dismantled years ago, built up a tailings dump of 400,000 tons. This material carries about $3 per ton in lead, silver, and copper. Property and assets of the Ophir Hill company, including the St. John and Ophir Hill Railroad, have been taken over by the International Smelting Company. The 10-mile branch railroad running into the old silver camp will be dismantled and the rails laid in the Bingham-Tooele tunnel being driven by National Tunnel & Mines Company.

▶ Several other mills are being discussed for Utah mining properties, among them the construction of a 1,000-ton cyanide plant at the Geyser Marion gold mine, at Mercur. During the last two years, F. B. Bothwell, general manager, reports that development has proved an immense body of low-grade ore, estimated to contain between 10,000,000 and 15,000,000 tons. The company is treating 300 tons daily. In two years, 80,000 tons have been treated averaging $3 a ton, and $225,000 in gold bullion has been produced. At present, the mill is treating 7,000 tons of ore and producing $18,000 a month. Power shovels mine the ore in open cuts. The new mill, when and if constructed, will be built 500 ft. down the canyon from the site of the old mill.

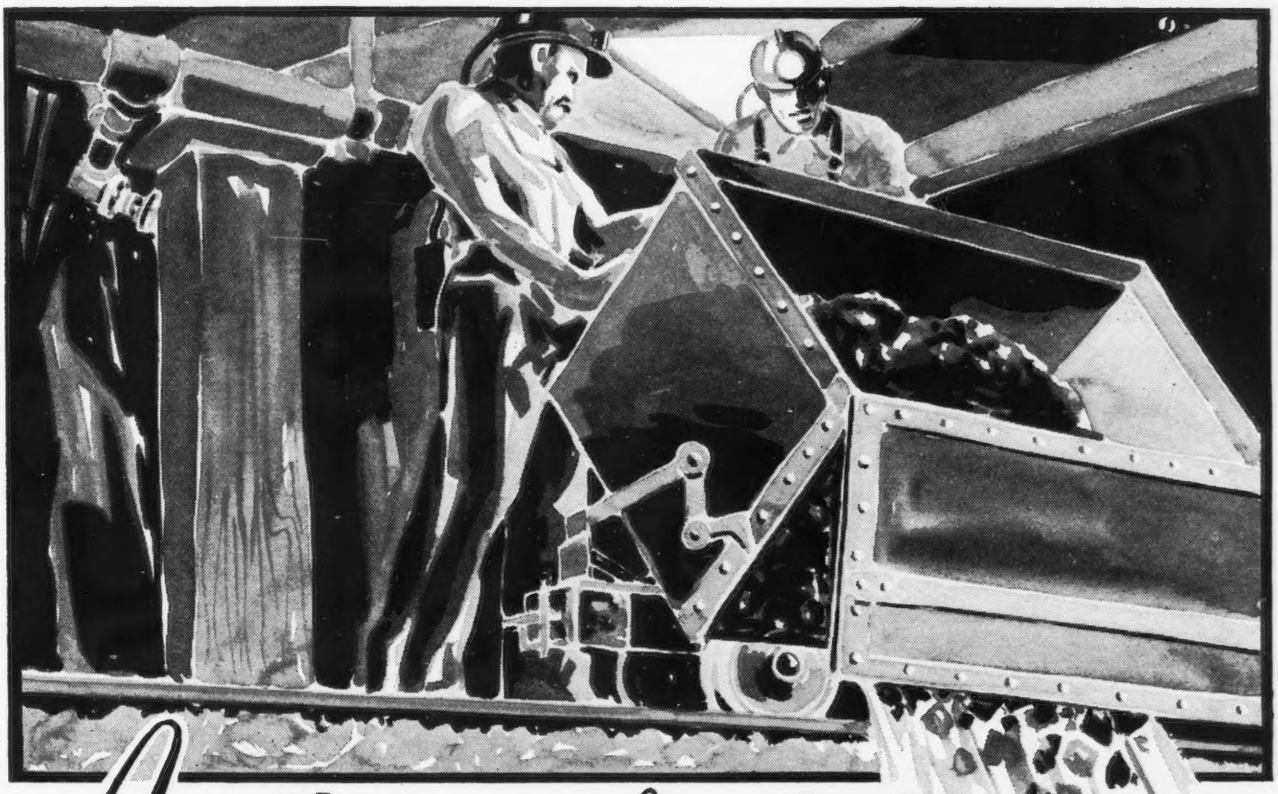
▶ Bog Mining Company, operating at the head of American Fork Canyon, has just completed the installation of a bunkhouse and compressor plant and the building of two miles of road for the haulage of ore and supplies by motor truck. A new McCormick-Deering diesel engine supplies the power for a Gardner-Denver compressor. Sullivan jackhammers and a Denver Dreadnaught drill are being used.

▶ Development is being done in the Cambrian quartzite, which has produced $50,000,000 in Park City and $250,000 in the near-by Pacific mine. A good grade of ore is being shipped from a winze below the main tunnel. Two drifts are prospecting the quartzite bed near a porphyry dike. M. A. Bourne, of Provo, is manager, and John Bestlemeyer is superintendent.

▶ Rapid progress is being made in the driving of the Utah Copper Company's 7 000-ft. vehicular tunnel to connect Bingham proper with Copperfield. Nearly one-third of the length has been driven. Some trouble has been experienced in the south adit with soft ground, so that this section is being lined with concrete. However, the present plan is to connect the two tunnels,



Good progress is being made in the $1,000,000 vehicular tunnel driven by the Utah Copper Company from Bingham Canyon to Copperfield, in the background. The solid lines indicate approximate distances already driven. Completion of this tunnel will allow the company to mine the orebody over which the present highway passes up Bingham Canyon



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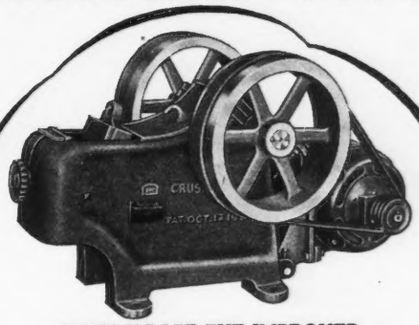

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one being driven from the north and the other from the south, and then complete the concrete work.

▶Tintic Ophir Mines Company, on Lion Hill, Ophir, has finished enlarging 1,200 ft. of its Buffalo Consolidated Tunnel to allow ore haulage by horses. Several drifts will be run to prospect the east and west flanks of the Lion Hill anticline along the Gladstone fissure system, a large producer in the upper levels.

▶The Desert Gold & Silver Mining & Milling Company's properties in Bullion Canyon, 6 miles west of Marysvale, are being reopened by the Iris Mining Company. The old shaft is being timbered down 160 ft. so that sinking to the limestone can be resumed, and the tunnel is being extended to open up the vein, which outcrops 800 ft. above. Ore is being mined from a showing in the tunnel. J. M. McLeod is superintendent and S. A. Cottrell, of Salt Lake, is president.

▶Mercur Dome Gold Mining Company has started sinking a shaft one mile west of Mercur. A gasoline hoist and a compressor have been installed. Twelve hundred feet of road work have been completed leading up Monument Gulch from the Mercur highway. Sam H. Buckley is president of the company and Frank H. Gunnell is consulting geologist.

Nevada

Mountain City Area Seeks More Electric Power

Present line from Idaho held inadequate to serve growing district—Pioche celebrates power service from Boulder Dam

▶Negotiations have been in progress at Boise, Idaho, with the purpose of securing adequate power service for the Mountain City area in northern Elko County. Present service over a line from Twin Falls has proved inadequate and several companies developing near Mountain City Copper have delayed sinking because of uncertainty as to whether electric or gasoline-powered equipment should be provided. Mountain City Copper, it was stated, has lacked sufficient power to operate pumps on deeper levels, and, while drilling a well in a near-by stream bed, has been drawing water for its mill from the 280-ft. shaft of Rio Grande Copper Company. Other operators in the district, in addition to Mountain City Copper, are to be represented at the Boise meetings.

▶Completion of a 150-mile power line from Boulder Dam to Pioche, in Lincoln County, and the beginning of power service, were marked by a celebration on Sept. 25 at the latter town. Producing companies that are availing themselves immediately of this power include the Combined Metals Reduction Company, Prince Consolidated Mining Company, Comet Coalition Mines Company, and Bristol Silver Mines Company. These companies have been shipping 2,500 to 3,000 tons of lead-zinc-silver-gold ore weekly to Utah for treatment, the greater part going to the Bauer plant of the Combined Metals Company near Stockton, Utah. Combined Metals has announced plans for early construction of an 800-ton mill employing selective flotation and for driving a 4,750-ft. crosscut on the 1,400-ft. level of its four-compartment Caselton shaft to connect with the No. 1 shaft at Pioche. International Smelting will employ diamond drills to prospect for deeper ore.

▶Mountain City Copper Company, in northern Elko County, is sinking its main shaft below the 700-ft. level and developing the wide orebody on that level. Local estimates place its current output at 3,500,000 lb. and its net earnings at $250,000 per month. The flotation mill treats around 500 tons per day, and trucks are delivering 100 tons per day or more to the rail point at Mountain Home, Idaho, for shipment to the International smelter at Tooele, Utah. State, county, and Federal highway authorities, meeting lately at Elko, agreed on measures to finance improvement of the road between Elko and Mountain City, providing a shorter truck haul and more direct outlet to the smelter. Senator Key Pittman, of Nevada, had an active part in effecting the agreement.

▶Storey County Mines, Inc., operating the Overland mine, north of Silver City in the Comstock district, is said to have exercised options held for some time on the adjoining Lager Beer, Succor, White Lead, and other old mines, opened to a depth of 1,400 ft. Drifts have been driven lately from the Overland, connecting with the Lager Beer on the 300- and 500-ft. levels. The amalgamating-flotation mill was enlarged last year from 35 to 100 tons' daily capacity. The Overland and some of the adjacent claims were owned formerly by the Comstock Silver Mining Company. Clyde E. Collins is superintendent.

▶The old Nevada Hills silver-gold mine, at Fairview, Churchill County, has been reopened by the Nevada Range Mines, Inc., headed by Sam Platt and John S. Sinai, Reno attorneys, with E. P. Jennings directing engineer. An outmoded stamp mill was replaced by a pilot cyanide mill that is being enlarged to 100 tons' capacity and equipped with new cyanide units and Merrill-Crowe precipitation plant. A three-year mill supply is estimated in addition to 350,000 tons of old tailing that samples from $3 to $7 per ton.

▶Three shifts of men are employed by the E. J. Longyear Company in operating a diamond drill near the Locan shaft of the Richmond-Eureka Company, owned by United States Smelting, Refining & Mining Company, on Ruby Hill, 2 miles west of Eureka. Drilling is conducted under contract from the Eureka Corporation, Ltd., composed of Canadian men who have acquired, under option or by purchase, a large number of claims and old productive lead-silver mines. The Locan 1,200-ft. shaft is being repaired in order to sample old mine workings. At this shaft the old 1,400-hp. steam plant, 1,500-cu. ft. compressor, and 800-hp. Nordberg hoist have been sold as junk.

▶Replacing an old 15-stamp amalgamating mill, new equipment is being delivered at the Mayflower mine, at Pioneer, southwestern Nye County, for a 100-ton mill with two-stage crushing, rod mill, amalgamating plates, flotation cells, and cyanide unit to treat concentrate. Power is provided by a 50-hp. and two smaller diesel engines and a lighting plant is powered by a 15-hp. Westinghouse engine. Most of the equipment has been shipped by the Denver Equipment Company. The property, foremost gold producer of the district and long idle, was acquired lately under option of purchase by the United States Milling Corporation from heirs of the late William J. Tobin. The purchase price is $80,000, with payments extending over ten years and flat 15 per cent royalty applying on the purchase price. Offices of the United States Company are in Wilmington, Del., some of the officers being connected with the du Pont de Nemours organization. F. E. Nemec, manager, has reopened several old mines in southern Nevada.

▶A new two-compartment vertical shaft on the Haystack mine of the Jungo Star Gold Mines Company, in the Haystack district, northern Pershing County, has been equipped with a hoist and compressor, and at a depth of around 40 ft. the shaft had exposed one of a series of veins that dip east toward the near-by schist-porphyry contact. The property was purchased by C. D. Terwilliger, president of the company, from George B. Austin, who some time ago sold the Jumbo mine, at Awakening, 45 miles to the north, to wealthy Texas oil operators, receiving $250,000 as down payment on a twenty-year $10,000,000 option.

▶At the Jumbo mine the amalgamating-concentrating mill designed by George Austin to treat 25 tons is now treating 40 to 45 tons per day. Some ore has been trucked 12 miles to the Daveytown mill, purchased last year by J. K. Wadley, one of the Jumbo optionees. This mill has been closed down lately for repairs. G. W. Schilling is now superintendent at the Jumbo mine and J. H. McCartney is manager in charge of various projects controlled by the Hunt-Wadley oil group.

▶Shipments are being made from the Grand Deposit Consolidated Mines, Inc., at Muncy Creek, Nevada, to the Garfield (Utah) smelter of the American Smelting & Refining Company. Ten out of twelve carloads shipped this summer carried a gross value of $21.60 a ton, according to Paul C. Lyon, president. Values were 6.79 per cent copper and 0.015 oz. gold and 9.24 oz. silver to the ton. The company has installed a new 100-hp. diesel engine, a new headframe, and ore bins. Clare Kimball and associates, who have leased the company's Kansas claim, have completed a bunkhouse for twelve men and installed a diesel engine and erected a compressor house.

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Greater strength--less weight
There is no unnecessary weight on this famous Bucyrus-Erie quarry and mining shovel. Its strong, simple, box-girder boom is welded into a single unit from the boom foot to the point. The combination of a lighter front-end and consequent lighter counterbalance, means less swinging load, faster starting and stopping — a high-speed, big output shovel that stands up to any kind of digging.
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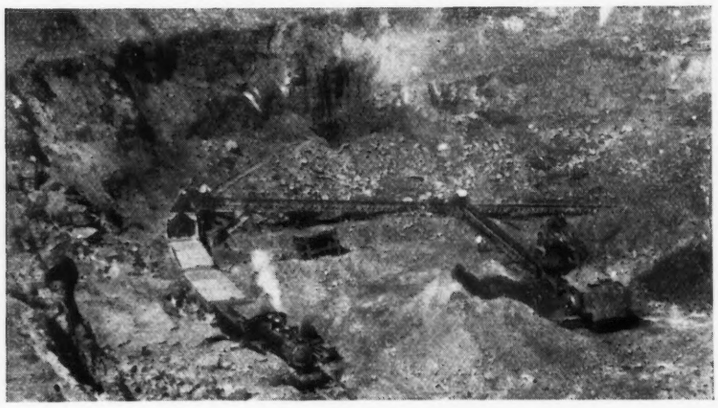

Iron ore from the deep section of the Canisteo pit of the Canisteo-Cliffs Mining Company, on the Mesabi range, is loaded onto conveyor belts which carry the ore to the waiting cars.

Iron Country

Ore Shipments Begin To Fall Off

Total tonnage for year will be short of 1929 record—More conveyor belt systems installed

▶ The ore business has declined slightly, as most of the shippers are either ahead or about at schedule, and it is now apparent that shipments will not reach the peak of 1929 by three or four million tons. The ore carriers on the Great Lakes are now using winter draft marks and the steamers are expected to carry much less per ship during the remainder of the season.

▶ The labor situation on the Mesabi range is quiet, the only new demand by the C. I. O. was to hand M. A. Hanna & Company a contract, which the company said it would look over. The C. I. O. was apparently disappointed over the contract with the International Harvester Company, as it did not give as much as the employees had before, except recognition, and some doubt if this is of any particular material advantage. The State Federation of Labor held a meeting the week of Sept. 20 at Hibbing and the C. I. O. delegates were refused recognition. T. E. Cunningham, of Minneapolis, president of the State Federation, ignored the requests of the C. I. O. and finally called a vote on the subject. The vote was 539 to 106 against C. I. O. affiliation.

▶ Equipment men, especially the tractor and truck men, are busy trying to interest mining men in trucks and tractors for various phases of mining, and in several instances this type of equipment is very successful.

▶ The Spruce mine, at Eveleth, Minn., is now milling pit ores with 25-ton trucks. The towers for the Sauerman scrapers have not been erected, on account of labor trouble early in the season at the Bucyrus plant, but they are expected soon. A 4,400-ft. belt conveyor moves the ore to surface, where it is loaded into railroad cars.

▶ The Charleson Mining Company is ready to turn over the new concentrating plant for the Judd mine at Taconite, Minn. Operation at this mine will be interesting, as the ore is conveyed from the pit directly into the mill. The mill is equipped with vibrating screens, a log washer, secondary crushers, Akins classifiers, and Ore Reclamation Company jigs. The tailing will be pumped to the tailing pond. Wilbur Schwarz is superintendent. E. F. Remer, of Hibbing, is president and his son, Charles H. Remer, is associated with his father in the various Charleson enterprises. The Pacific mine of the same company has shipped 100,000 tons of ore so far this year. A 1¾ Marion diesel electric shovel loads the ore into trucks and these are dumped over a ramp into railroad cars. Fred Flink is in charge of this operation, which is at Aurora, Minn.

Tri-State

New Mill Necessary for Treating "Circle" Ore

Carbonate and siliceous zinc occurrences found on stripping area in Oronogo Circle—Eagle-Pitcher Mining & Smelting Company is sinking a shaft near Picher

▶ The Ritter Mining Company will finish the construction of its 150-ton mill on the High Five lease, in the Waco field, early in October, according to C. W. Ritter, who is in charge of the property. The company has developed a promising orebody on the 110-ft. level, where further work will be carried through two shafts about 100 ft. apart.

▶ Oronogo Mutual Mining Company is building a 200-ton mill at Oronogo, Mo., to concentrate the partly oxidized lead and zinc ores from the Oronogo Circle, according to Guy H. Waring, manager. Stripping operations at the "Circle" have uncovered a considerable tonnage of zinc silicate and lead carbonate which cannot be economically treated with the regular sulphide ores of the district. The sulphide ores to be recovered at lower levels in the "Circle" will probably be sent to the Central mill of the Eagle-Picher Mining & Smelting Company near Commerce, Okla.

▶ Federal Mining & Smelting Company started its new mill at Spring City, Mo., early in September, but shut down to make necessary changes. The mill has a capacity of between 40 and 50 tons an hour and will treat ore from a group of leases in the vicinity. Ore will be trucked from the various leases to two 150-ton hoppers at the mill. The company is also constructing eleven new hoppers on five leases in the Picher camp to furnish ore to the new central mill which the company is constructing

Stripping overburden at the Oronogo Circle Mines. Benches shown in center have uncovered partly oxidized ores, which will have to be treated in a new mill being constructed for this purpose by the Oronogo Mutual Mining Company, at Oronogo, Missouri

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on the Gordon lease, according to L. G. Johnson, district manager of the company. The new mill will have a capacity of 100 tons per hour and will be equipped with adequate sampling facilities.

▶ Eagle-Picher Mining & Smelting Company is sinking a 460-ft. shaft on the Garrett land, 4 miles north of Picher, in Kansas, according to G. C. Niday, district manager of mines for the company. The shaft will be 5x9 ft. in the clear. It is being sunk on a drill hole which was grouted with cement under pressure to block off the heavy flow of water indicated in drilling. Thirty-nine hundred sacks of cement were pumped into the drill hole.

▶ The Baxter Chat Company has dismantled its tailings re-treatment mill on the Hartley lease west of Baxter Springs and will rebuild a mill with a capacity of 60 tons of tailings per hour on the Big John lease of the Eagle-Picher Mining & Smelting Company, a mile northwest of Treece, Kan., according to J. L. Smith, company manager. The new mill is expected to be in operation late in October.

Michigan

Lake Superior Copper Mines Active

Rehabilitation, prospecting, and exploration of various deposits under way—Good results on recovery reported at Quincy mine on ore from upper levels

▶ Quincy Mining Company now has three stamp heads at work in its mill, and two more are being repaired. Copper extraction per ton of rock is in the upper brackets of the best in Quincy's history. Ground to the north is good and present tonnage is being produced from the upper levels, between the 81st and 87th. Two shafts are operating, Nos. 6 and 8. The company has received more than half of its supply of winter coal and extensive repairs to the coal dock and shed have been completed. A total of 425 now are employed by Quincy.

▶ Isle Royale Copper Company is making good progress in dewatering its mine preparatory to resumption of mining. The water in No. 4 shaft has been lowered from the 17th to the 19th level, about 250 ft. No. 5 shaft is being retimbered. This work, now completed to the 8th level, will continue to the 17th, which was the water level, and below that point if necessary. At the stamp mill a new roof and new stack have been completed and other repairs are under way.

▶ At the Michigan copper mine, in Ontonagon County, which Calumet & Hecla is investigating under option, shaft "E" has been cleaned out and drilling is in progress. There was little water in the shaft and drifts are in good condition.

▶ Exploratory work at the St. Louis property of the Calumet & Hecla, in the Calumet district, is proceeding satisfactorily, developments to date being encouraging. The shaft is down about 60 ft. and drifting is in progress along a fissure vein toward the St. Louis conglomerate and St. Louis amygdaloid. The fissure is strongly mineralized, both large and small "mass" copper being found in drifting. The permanency of this property depends on the mineralization found in the two main lodes.

▶ Developments at the Globe property of Copper Range are encouraging. Good copper ground has been proved between the 9th and 18th levels. Copper Range is doing some diamond drilling at its White Pine property, in Ontonagon County, the results to date giving much encouragement.

Mexico

President Cardenas Lauds Small-scale Miners

He says Federal mineral reserves are to be increased—Mining company files suit against Ministry of National Economy

▶ Government encouragement and aid are to continue to be given prospectors and other small-scale miners of Mexico, and the State is to otherwise foster Mexican elements of the mining industry to assure more benefits for the people, according to President Lazaro Cardenas in a statement in his recent annual message to Congress. Federal mineral reserves are to be built up further, he announced. He announced also that during the year ended Aug. 31, mining production featured: 23 metric tons of gold; 2,400 tons of silver; and 424,000 tons of miscellaneous industrial metals.

"It is a noteworthy fact that much of this production was accounted for by small-scale miners, operating with national capital, and by groups of workers organized to exploit important deposits in various regions," the President said. "This demonstrates that the workers realize the importance to themselves, as well as to national prosperity, of this activity. The Federal Government is giving attention to constituting great national mineral reserves and to forming organizations that are favorable to the miners and the Mexican collectivity, so that benefits from this industry shall be for the people and the country instead of going abroad, as was the case until recently. There has been a marked increase in the number of applications by individual Mexican miners, groups of them and Mexican companies, for concessions to explore and exploit mineral tracts."

▶ The national miners' union is to hold a convention in Mexico City starting Oct. 30 to discuss such matters as obtaining a single work contract for the entire industry.

▶ Pleading lack of funds for further work, the Republican Mining & Metal asked the labor authorities for permission to stop operations on Sept. 30 at its holdings near Venado, San Luis Potosi. The workers object to the proposition, and intervention of the Federal Government is expected.

▶ Exports of mining products were at a high level in April, the most recent month for which official figures on the subject are available. These shipments were as follows, the amounts being in kilos: Gold: 2,645 (2,637 to the United States, five to Belgium, three to France); silver: 186,596 (109,847 to the United States, 74,122 to Great Britain, 1,060 to France, 867 to Belgium, and 700 to Germany); copper: 4,203,156 (4,105,790 to the United States); lead: 23,802,531 (3,395,088 to the United States); zinc: 13,021,408 (666,310 to the United States); mercury: 13,329; molybdenum: 99,668; antimony: 961,482; graphite: 1,183,564; arsenic: 972,381; tin: 17,675; and cadmium: 37,203.

▶ A suit which promises to set a precedent in action governing incorporation of mining operations into Federal mineral reserves has been filed in a Mexico City court by Cia. Minera Las Truchas against the Ministry of National Economy adding some of its iron mines to the reserves. The company states its concession to the mines extends back 30 years.

▶ Cia. Minera del Cubo lost a weekly payroll of 6,000 pesos (some $2,158) when twelve armed bandits assaulted the assistant paymaster, Arturo Garcia Laborde, and his two Mexican aides near the company's property at El Cubo, Guanajuato. A bandit was killed in an exchange of shots with Garcia Laborde and his men. This was the first bandit robbery of a mining property in Mexico in many months.

▶ The Federal and states governments are seeking to end the strike which has halted work for Cia. Minera Promontorio, Promontorio, Durango, since April 8. The Durango Government gave the strikers a large supply of wheat and "frijoles." This property is now owned by Mexicans, Lanuk and Manzanera del Campo, who bought it from Albert Ransom soon after the strike began. The Del Campos are parleying with the strikers in an effort to attain a settlement and hasten operation of the mines.

▶ Another Mexican mining company has passed into the hands of its employees to work on a cooperative basis. This fate befell Cia. Minera Diaz Olachea, operating in the San Antonio district, southern Lower California Territory, as a means of settling a labor conflict.

▶ The Mexican Government has discontinued the practice of forfeiting mining rights if a third party signed a report stating the mine was inactive. Some time ago several titles were cancelled in this manner, although their dates were prior to Aug. 2, 1926, and the surface mining taxes had been paid uninterruptedly.

▶ Last year the Ministry of National Economy submitted to President Cardenas a new mining law granting him

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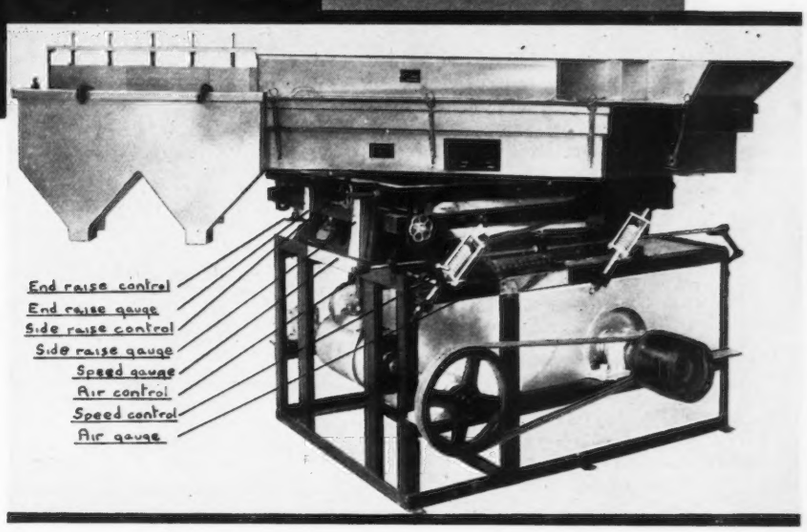

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▶MEXICO

unusual powers to legislate on mining matters. One of the articles calls for the investment within the country of 25 per cent of a mining company's profits. Proposal of this law went unchanged in spite of strong objections raised by large and small mine operators. President Cardenas still has this proposed law, and since the special legislative powers conferred upon him by the Congress expired on Aug. 31, it is apparently understood that he did not see fit to issue this piece of proposed legislation.

▶ The Secretary of Communications has been threatening the Mexican mining industry with an increase of from 300 to 400 per cent in railroad freight rates on ores, concentrates, and other metallurgical products. The National Mining Association has strongly opposed such an absurd measure, and President Cardenas has ordered the Secretary of Communications to stop further proceedings.

▶ Higher wages and several other liberal concessions have been made workers by The Mexican Candelaria for its units at San Dimas, Durango, and Contra Estaca, Sinaloa, of which Charles W. DeWitt is general manager. The wage increase is retroactive from July 15.

About 200 miles north of the Gulf of St. Lawrence the Labrador Mining & Exploration Company has completed its second year of prospecting. Bellanca airplanes bring supplies via Ashuanipi Lake. Dr. J. A. Retty, on the right, supervises the geological work.

Canada

Extensive Prospecting Program in Labrador

Airplanes and radio communication speed work of seven field parties—Highest mineral production in Canadian mining history expected this year

▶ Mineral production in Canada during the first half of 1937 established a new record in Canadian mining history, according to a report made public by the Division of Regional Information, Department of Commerce. Production value is placed at $50,000,000 higher than in the first six months of 1936, or a gain of 23 per cent. Higher volume and values for metals accounted for $42,000,000 of the advance. Output of gold, the leading item, approached 2,000,000 oz., with a value of nearly $69,000,000, as the extraction by established mines was augmented by newly developed areas and revived production in abandoned mines. Copper accounted for $34,400,000 of the total metal production, which was a $16,000,000 advance, caused chiefly by higher prices. Copper operations in British Columbia have been resumed, and a large mine in Manitoba, closed for five years, began production in August, according to report. Among other metals the output of nickel gained 34 per cent in volume, silver and lead gained 10 per cent, and zinc 8 per cent.

▶ Satisfactory progress is reported by the Labrador Mining & Exploration Company, Ltd., for the company's second field season in southwestern Labrador, where a ten-year concession on an area of about 20,000 square miles was granted the company early in 1936 by the Newfoundland Government. Last year a program of mapping was started by geological parties under the direction of Dr. J. A. Retty. The Labrador interior was reached by way of an air route from Seven Islands, on the Gulf of St. Lawrence, up the Moisie River and across the height of land to Ashuanipi Lake. A permanent base camp is now located at Northwest River, a small trading post at the head of Hamilton Inlet. The base is radio equipped both for communication outside and with the field base on Sandgirt Lake. Two Bellanca Skyrocket planes have completed this second season with a good record of efficient transportation. Newfoundland Skyways Limited, in charge of these air services, is a company owned jointly by Dominion Skyways and the Labrador Mining & Exploration Company. In 1936 the field work was carried on by fifteen men, including six geologists. This year the number was increased to 33. The men were divided into seven field parties, half of them prospecting in areas previously investigated and the others engaged in geologizing new territory. Grand Falls, rated as the largest undeveloped waterpower on the continent, is within the limits of the concession, a party of prospectors having been located in its vicinity this summer. Further investigation has been directed to the northwestern quadrant, where one of the largest known deposits of hematite was first reported many years ago. McKay (Quebec) Exploration, Ltd., has been directing the Labrador program, under the personal supervision of Julius M. Cohen, consulting engineer. Recently Mr. Cohen completed an inspection trip by plane, covering the distance from the Sandgirt Lake base to Montreal in 8½ hours, including one refueling stop at Seven Islands.

▶ Cline Lake Gold Mines, one of the important new developments in northwestern Ontario, has started building a mill with an initial capacity of 200 tons and so designed as to allow for expansion. Cline Lake is a subsidiary of O'Brien Gold Mines, whose field engineer, Dr. W. S. Dwyer, is credited with blocking out the large orebody that was diamond drilled a year ago. The property is 25 miles northeast of the Helen iron mine, in the Goudreau area. The main ore zone has been traced by drill holes for a total length of 2,000 ft., the width averaging better than 10 ft. Gold values, after deducting 30 per cent for dilution, average $13.85 per ton. To a depth of 300 ft. a block of ore is indicated amounting to 300,000 tons, not including several smaller lenses located by the diamond-drilling program. Shaft sinking was seriously delayed just below the 250-ft. level by a heavy flow of water, but this is now cemented off. It is estimated the objective in sinking 500 ft. will be reached near the first of November. While sinking operations were suspended an exploratory crosscut was driven out on the 250 level, and near the eastern end of the main orebody a width of 19 ft. was intersected. Samples at this point are reported to average slightly under $6 per ton. Operations are in charge of A. H. Hinton and Dr. George Furnival. The company has laid out a model townsite that compares favorably with surface development on any mining property in the country. Four large bunkhouses are now in use and fifteen houses are under construction.

▶ Efforts are being made at the McKenzie Red Lake mine to rush a program of development work at depth, following delays in installing a new hoist. The lower levels are opened up by a winze completed late in September to a depth

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of 850 ft. New hoisting facilities will make it possible to concentrate mining efforts on the promising ore exposed on the 550 and 650 levels, where irregular lenses of gold-bearing quartz occur in a shear zone up to 30 ft. in width. Under the management of L. L. Ramsell, who was formerly in British Columbia with Britannia Mining & Smelting, the McKenzie Red Lake has been developed to a depth of 450 ft. by vertical shaft and below that through a winze. Satisfactory production had been maintained until the quarter ended last June, when the grade of ore began to diminish. Value of output for the quarter totaled $200,000, the mill operating at 150 tons daily. M. L. Fairlie is the consulting engineer.

▶ A decision on mill construction is expected to be made by the management of the Francoeur mine, in the Rouyn district near Arntfield, Quebec, as soon as oreshoots intersected in the new shaft have been explored on the second level, 125 ft. below the first. Early in September the second level crosscut picked up the ore, and development work is progressing favorably. The important "A" oreshoot has been developed on the first level for a length of 210 ft. and shows a gold content of $9.83 across widths averaging 35 ft. On the same level a better grade of ore has been found in the "B" shoot, with $12.18 across 7 ft. for a length of 193 ft. "D" ore lens has also been explored to establish a grade of $7.28; the width averages 6.5 ft. for a length of 127 ft. A substantial tonnage has been developed to a depth of 500 ft. through the No. 1 shaft, which is 2,000 ft. east of the present workings.

▶ What probably amounts to the most spectacular discovery this season in the northern Quebec mining district was made late in June by a prospector named Paddy McDonough. Maniwaki Gold Mines, Ltd.. has been formed, with Charles D. Kaeding as managing director and H. C. Laird as geologist, to develop the new property. Both men are prominent in Canadian mining. With strong financial backing, they have launched a program of systematic exploration on the major ore zone which has been indicated in two trenches 195 ft. apart. Concentrations of coarse gold occur in quartz stringers intrusive through an acid rock that has been classified as granodiorite. Tourmaline and sulphides accompany the free gold. It is planned to delay diamond drilling until bed rock has been stripped for the entire length of the mineralized zone.

▶ Jacola Gold Mines, formerly the Greene-Stabell mine and located immediately east of Sullivan and Siscoe, in northern Quebec, reports that high-grade ore has been opened up in an area not previously tested along the main granodiorite contact. This is considered by the manager, C. S. Johnson, to be the most favorable ore development in the mine's long struggle to keep going. The discovery is at the end of a crosscut 190 ft. long which was driven on the 1,000-ft. level to intersect the contact zone. Lateral development from the crosscut has exposed considerable free gold in ore that is described as typical of the "K" zone material at the Siscoe mine, on the same strike. Until further work has been done, no estimate of average values will be attempted, due to the irregular distribution of precious metals.

▶ Hard Rock Gold Mines, adjoining McLeod-Cockshutt on the east, in the Little Long Lac district, announces that mill construction is advancing on schedule and that first production is expected to be made within the next four months. The mill will be rated at 150 tons, with crusher capacity of 275 tons daily to allow for expansion later. In the course of the last few months of intensive underground exploration two veins have been developed, No. 2 vein occurring in graywacke and No. 1 along a porphyry contact some distance to the south. The first shaft on the property is on No. 2 vein, which has been developed on two levels to block out ore grading approximately $14 a ton. No. 2 shaft is on No. 1 vein, which is now being explored on the 250 and 475 levels. A long exploratory crosscut is being driven at the 475-ft. horizon to connect with the No. 1 shaft, and a crosscut from the 250 level is going out to explore a new ore zone near the McLeod-Cockshutt boundary, following up evidence from a series of drill holes.

▶ A report from John W. Shaw, consulting engineer, shows satisfactory improvement in ore reserve position for J-M Consolidated Gold Mines, operating a 100-ton mill near Woman Lake, in the Patricia district of Ontario. The new orebody being developed through No. 2 shaft is expected to be ready early in October to supply mill feed at the rate of 25 tons daily. On the 250 level the vein structure is reported to be stronger than on the level above. Channel sampling has given values up to $28.90 across widths ranging from 24 to 44 in.

▶ The McKenzie mine, at Cedar Bay, is closing down, regardless of satisfactory ore developments secured from two years of underground work. Consolidated Mining & Smelting Company of Canada has dropped its option on the property after taking up all but 140 000 out of 1,800,000 shares involved in the negotiations with Consolidated Chibougamau Goldfields. An announcement was made by J. J. Warren, president of Consolidated Smelters, to the effect that other financial interests will have to enter the Chibougamau picture before work is resumed at the McKenzie mine.

British Columbia

▶ Vancouver was host last month to the most important mining convention ever held in western Canada—a joint meeting of the American Institute of Mining and Metallurgical Engineers and the Canadian Institute of Mining and Metallurgy. Almost 400 persons registered, of whom more than a hundred were from widely scattered parts of the United States, and almost an equal number were from Canadian points outside of Vancouver. The visitors included R. C. Allen, of Cleveland, Ohio, and A. B. Parsons, of New York, president and secretary, respectively, of the American Institute; Dr. J. W. Finch, director of the United States Bureau of Mines; Dr. W. C. Mendenhall, director of the United States Geological Survey; D. Harrington, chief of the health and safety branch of the United States Bureau of Mines; and many other eminent American engineers and geologists. Among the Canadian visitors were the Hon. Michael Dwyer, Minister of Mines for Nova Scotia, and E. J. Carlyle, president and secretary of the C.I.M.M.; the Hon. T. A. Crerar and Dr. Charles Camsell, Minister and Deputy Minister of the Dominion Department of Mines; Dr. T. A. Rickard; and G. C. Bateman, secretary of the Ontario Mining Association. A wide range of technical subjects were discussed in the technical sessions, and during the week of the meeting, Sept. 13 to 20, excursions were made to Victoria, where the delegates were received by the Lieutenant-Governor, and to the Bridge River mining district.

▶ In the Portland Canal district, concentrate having a net smelter value of $108,746 was produced at the Silbak-Premier mine in July, from 15,518 tons of ore. An operating profit of $24,118 was earned. A small sampling plant has been built at Prince Rupert by the Provincial Government for the purpose of aiding small operators and prospectors in the northern regions to dispose of ore and concentrate. Dr. Joseph T. Mandy, resident engineer for the district, has been given charge of the plant. Additional machinery is being installed at the Esperanza mine, at Alice Arm, to increase the milling capacity from 35 to 40 tons a day.

▶ At the Georgia River mine, the dry-grinding mill installed three months ago is being replaced with a standard-type mill of 25 tons' daily capacity.

▶ Results obtained in the Zeballos River district, Vancouver Island, continue to be highly satisfactory, and it is now manifest that several small producers of high-grade gold ore will be developed. A. B. Trites, owner of the Goldfields group, reports that a 25- to 50-ton mill will be built at his property as soon as a 6½-mile road is completed from tidewater.

▶ A shear containing clean zinc blende replacements and varying amounts of zinc and copper sulphides is being developed at the Danzig mine, near the mouth of Silverado River, west coast of Vancouver Island. J. J. Badraun, of Seattle, is president and general manager of the operating company. It is stated the vein has been disclosed for a distance of 600 ft. in the principal open cut, and that it is traceable apparently for a total length of 4,000 ft. A dock for sea-going vessels, ore bins, and a road are being built to enable crude ore to be shipped.

▶ A new ball mill was brought into operation on Sept. 12 at the Bralorne, Bridge River district, increasing the milling capacity from 475 to 550 tons.

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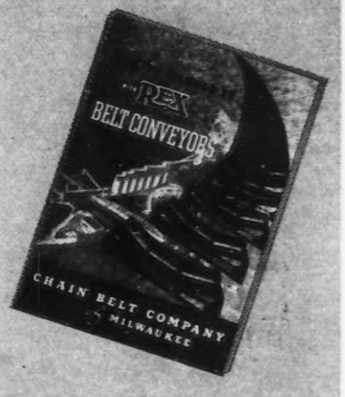

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R. Bosustow, managing director, states it is not planned to increase production for the present.

▶At the B. R. X. property, the California shear was encountered recently in the crosscut from the foot of the new 500-ft. shaft, and drifts are being advanced along it north and south. Values are better than at upper levels. E. R. Shepherd is manager.

▶The continuation of ore beyond the "F" fault has been opened at the Fairview Amalgamated on the second level. The ore was 11 ft. wide where opened, and the hanging wall assayed 0.68 oz. gold per ton across a width of 1 ft. The average of muck samples was 0.2 oz., which is somewhat better than mine average. J. A. McKenzie is superintendent of the mine, which is situated near Oliver, in the Similkameen district.

▶More customs ore was received in the first half of 1937 at the Trail smelter of the Consolidated Mining & Smelting Company from mines in the Kootenay-Boundary county than in any previous half-year. From 57 properties, 5,085 tons was shipped, and from 10 producers, 3,891 tons of concentrate was sent for treatment. In the same period 246,767 tons of concentrate was shipped to Trail from the company's plant at Kimberley, the output of the Sullivan mine.

Australia

New Zinc Producer Expected in 1940

Large orebody prospected by diamond drilling—Iron-ore resources are considered ample to permit exports to Japan

▶New Broken Hill Consolidated, which is developing a lease to the south of the Zinc Corporation at Broken Hill, should be in operation by 1940, according to the statement of the Chairman, Viscount Horne, at a recent meeting in London. No. 8 borehole (depressed angle 80 deg.), after traversing lode material for a drilling distance of 484 ft., is now in footwall country and has been stopped. The true width of the lode is as yet unknown, but it is obviously considerable.

▶A preliminary report has been received by the Commonwealth Government on the iron-ore resources of Australia, and further information is being collected. It is announced that there is no present intention of restricting exports, and that this will not be considered at all until the full report is available. Operations at Yampi Sound, W. A., where £100,000 has already been spent, and expenditure at the rate of £12,000 per month is still proceeding, on plans for the mining of the deposit at the rate of 1,000,000 tons annually for shipment to Japan, will proceed untrammeled, as reserves are so large that the projected rate of exploitation will not cause serious diminution of the supply for many years.

▶Ore reserves at the Moonlight gold mine, near Wiluna, W. A., are set down on Dec. 31 last as 338,000 tons assaying 6.2 dwt. per ton. This shows an increase of 200,000 tons for the year, during which (from April) 65,450 tons were mined at an average cost of 16s. 10d. per ton. Milling was carried out at the plant of Wiluna Gold Mines, Ltd., 58,012 short tons being treated at a cost of 4s. 9d. per ton. Assays were 6.2 dwt. gold and 1.27 per cent antimony, the flotation recoveries being 89 per cent of the gold and 93 per cent of the antimony. That part of the concentrate which is highest in antimony is being shipped to Europe, the remainder being treated satisfactorily in the Wiluna smelter.

▶Interest has been caused recently at Broken Hill by drilling operations on the lease of Barrier Development Silver-Lead, a syndicate which is prospecting to the north of the property of North Broken Hill, Ltd. Drilling at a depressed angle of 62 deg., the drill encountered sulphide ore at a depth of 48 ft., equivalent to 270 ft. from surface, and passed through the lode at 431 ft. The formation is stated to be similar to that met with in the Main Broken Hill mines. A second borehole has been commenced 478 ft. south of No. 1. So far no assays have been released. Up to date seven prospecting companies have been formed, and development work on their leases is planned for the near future.

▶Western Australian gold yield for July was 84,337 oz., an increase of 7,000 oz. above that for July, 1936, making the yield for the first seven months of the year 555,392 oz., which is greater than any annual output from 1921 to 1931.

▶Production at the Edna May mine, Westonia, W. A., which has been under development for some time, has commenced at the rate of 1,000 tons of ore a month, and will soon be doubted.

▶Yellowdine Gold Development, at Yellowdine, W. A., reports that favorable developments at depth on the new east lode continue. The lode has so far been proved to a depth of 300 ft., average values from 200 to 300 ft. being 14 dwt., with the full width of the lode not exposed in the winze. The main shaft has reached a depth of 285 ft., and within two months or so the main and east orebodies will be opened up at the 300-ft. level.

▶Central Norseman Gold, at Norseman, W. A., reports that the first section of the enlarged treatment plant went into operation early in August. Due to delay in delivery of the new main winder, however, it is not expected that full output of 6,000 tons per month can be reached until about October.

▶Reviewing the progress of Victorian mining during the year to June 30, A. H. Merrin, President of the Chamber of Mines, said that, although gold output had increased to 133,000 oz., compared with 97,000 oz. during the previous twelve months, the hope of a marked revival at Bendigo had not materialized yet, and operations on the deep alluvial mines in the Caralulup and Avoca districts had not met with success.

▶North Star Gold Mines has been formed with a nominal capital of £200,000 to acquire the old North Star mine, at Moyston, near Ararat, Victoria, which was worked with some success to a depth of 520 ft. about 70 years ago and later abandoned on account of water difficulties. English capital is interested in the venture.

▶Australian gold yield for the twelve months ended June 30 is estimated at 1,290,849 oz., an increase of more than 230,000 oz. over the record for the preceding twelve months. Principal increases in production were in Western Australia and in Victoria. The former State produced 72 per cent of the total yield of the Commonwealth.

▶North Kalgurli (1912) Ltd., Kalgoorlie, W. A., reports that developments to date on the N. E. D. lode, which has been located from the No. 6 to the No. 15 levels, indicate a length of 50 ft. and width of 25 ft. over a depth of 710 ft. It is estimated that this will yield approximately 71,000 tons assaying 1 oz. per ton, with the possibility of further substantial additions as development work proceeds.

▶The Commonwealth Government proposes to purchase one complete depth-drilling unit and two scout boring plants capable of drilling to 3,000-4,000 ft., with the object of stimulating the search for flow oil in Australia. It is proposed to rent the plants to approved prospecting companies.

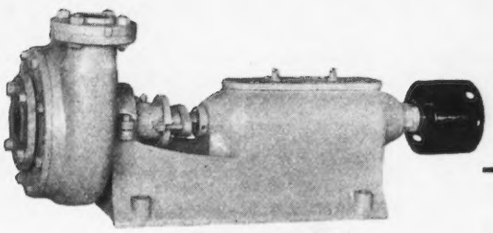
▶Broken Hill Proprietary Company, operating iron ore deposits at Iron Knob, S. A., and steel works at Newcastle, N.S.W., with control of allied industries at Newcastle and Port Kembla, N. S. W., reports that the year to May 31 last was a record. Production was 669,000 long tons of pig iron, 783,000 tons of steel ingots, and 600,000 tons of coke, and net profits totaled £1,183,000—an increase of £333,000 over the figures for the previous year. An extensive program of plant additions and improvements is proceeding.

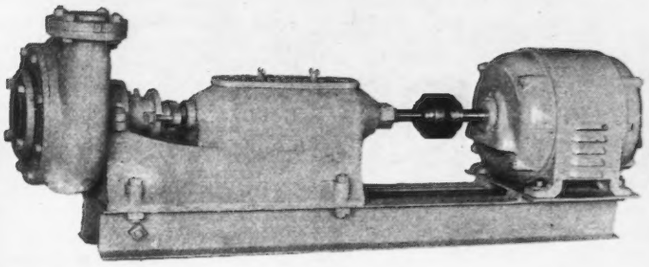
▶North Broken Hill, Ltd., during the financial year ended June 30 last, treated 434,867 tons of ore, producing 80,310 tons of lead concentrates and 74,740 tons of zinc concentrates. It appears certain that last year's profit of £636,940 will be materially exceeded in view of the high average prices of base metals during the past year.

▶Cocks Pioneer Gold & Tin Mines, operating a gold and tin property at Eldorado, Vic., recently encountered hard clay, which suspended operations pending boring to determine the course of future operations.

▶Triton Gold Mines, Cue, W. A., reports that the lode at the No. 4 (425 ft.)

The New Model "100" SAND PUMPS By





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▶AUSTRALIA

and No. 5 (550 ft.) levels has been stripped to full width. At No. 4 the main shoot is 707 ft. long and 11 ft. wide, averaging 9.9 dwt., and the southern shoot 94 ft. long, averaging 5.4 dwt. over 8 ft. 4 in.

▶The promised commencement of operations at Rothsay Gold Mines, Rothsay, W. A., has not materialized, due, the management says, to unforeseen delays in the delivery of essential machinery and to the flooding of the mine by excessive rains. It is thought several months will elapse before unwatering is completed and stope preparation is sufficiently advanced to permit of the starting of production.

▶Figures for the production of lead and zinc concentrates at Broken Hill for the year 1936 have just been released and compare with the previous year as under:

Year	Long tons	Average Assays Lead per Cent	Silver, Oz.	Zinc per Cent
		Lead Concentrate		
1935.....	245,007	74.5	32.5	4.5
1936.....	244,291	74.7	32.6	4.5
		Zinc Concentrate		
1935.....	245,401	1.6	2.1	53.3
1936.....	245,554	1.4	2.1	53.2

The tonnage of ore treated in 1936 was 1,355,821 long tons. The peak year for lead concentrates production was 1929, when output was 282,863 tons, and the record zinc concentrate output 302,605 tons in 1927, but there have been material improvements in the grade of both products since that time.

▶Great Boulder Proprietary, Kalgoorlie, W. A., reports a net profit of £87,066 sterling for the year 1936, compared with £70,636 in 1935. Ore reserves show an increase of 139,000 tons to 837,000 tons averaging 7.2 dwt. per ton, despite a considerable increase in the tonnage milled. Costs were 25s. 6d. sterling per short ton.

Fiji Islands

Good Ore Found in Depth at Loloma

Encouraging prospects are reported from development on 225 level—New mill commences first operations

▶Preliminary operation of the Loloma plant, at Tavua, started early in September. From the North drive on the 120-ft. level of the mine, No. 1 winze is being sunk and is down 73 ft. in ore averaging 11 dwt. No. 2 winze from the South drive on the same level has been sunk 45 ft. in 10-dwt. ore. The south drive off the East crosscut at 122 ft. in No. 2 adit has entered values which from 105 ft. to 124 ft. averaged 10 dwt. over a width of 4 ft. At the 224-ft. level, at present the deepest in the mine, ore assaying 18 dwt. per ton over a width of 39 in. has been encountered, with value and width improving as the drive advances.

▶Plant construction at the Emperor mine is also well advanced, although completion was not expected until early in October. Recent development work in a rise off a drive at the No. 2 (190 ft.) level has shown values which are the furthest east yet found, and give promise of further new ore.

CORNWALL TIN MINES GAIN PROMINENCE

A PLAN for the exploration of large areas including several of the old mines in the Cornwall tin belt has been brought almost to the stage of the beginning of underground activities. British (Non-Ferrous) Mining Corporation, of which Sir Cecil Budd is chairman, proposes to spend £30,000 to £40,000 on exploration when it has acquired the prospecting rights and options to take mining leases which it desires. It is understood to have secured such agreements with several companies, and also with the Dutchy of Cornwall; but Lord Falmouth, one of the largest owners, is not yet ready to accede to the plan proposed. His view evidently is that the properties should be explored separately, no connecting openings being driven. It is likely that he is being given some support, as there is more or less opposition to the consolidation of the mines in the best part of the district into one or two big companies, which is assumed to be the object in view.

BRITISH (NON-FERROUS) interests are evidently looking at Cornwall's tin from the more modern angle. It is rumored that the corporation expects to discover hitherto unknown lodes, to connect the workings on the known lodes so as to permit systematic mining, and possibly to erect one or two central milling plants. Those interested will not wish to be restricted in their activities. In the meantime the few mines being worked in Cornwall are doing well on the prevailing price of tin.

DISTURBED CONDITIONS in China and fear of their long continuance caused the price of wolfram to advance 45 per cent, and of antimony 20 per cent, within a month. The development of known deposits of these minerals and the possible discovery of others elsewhere in the world are already receiving consideration. Tin mining in Cornwall will be further stimulated, as wolfram is an important by-product of Cornish ores.

East Indies

Tin Producers Grant Higher Dividends

Production costs are reduced by Kramat Tin Dredging Company—Ipoh Tin finally exhausts the rich Ayer Etam area

▶Ipoh Tin Dredging reports a decrease of £32,074 in its net earnings for the year to March 31, its profit being £48,213, against £75,287 the year previously. The decrease is due to the rich Ayer Etam area having been exhausted. But this was anticipated, the balance of the Ayer Etam investment having been written off from the profits of the previous year. Application has been made for a grant of other ground in the vicinity of Ayer Etam which it is believed can be worked profitably. R. Pawle, the chairman, says with tin at £200 a ton there are a number of profitable years ahead at the Lahat property, which is 6 miles from Ipoh, State of Perak, Federated Malay States. Ipoh's subsidiaries, Kinta and Temoh, are making substantial profits. The strong balance sheet position of Ipoh has caused the final dividend to be increased to 2s. 6d. per share, against 2s. a year ago.

▶Kramat Tin Dredging (incorporated in the Federated Malay States) reduced its production cost to £30 6s. 9d. per ton of concentrates, from £37 5s. 1d. the previous year. Its production of 1,021 tons was sold for £131 3s. 8d. per ton, and net earnings were £99,104, being up from £80,403 the previous year, and dividends paid, 10s. per share, absorbing £82,500, were double those of the preceding year.

▶Dividends by tin producers are being increased quite generally. Tronoh, Southern Tronoh, Kinta, and Tanjong Dredging are among other Malayan tin producers to pay larger amounts the past year.

Tasmania

Lead Output from Rosebery Sold to A. S. & R.

One-year contract signed—Montana, Western Extended developing promising lead deposit near Zeehan

▶It is announced that the Electrolytic Zinc Company of Australasia, Ltd., has entered into a twelve months' agreement to sell its lead concentrate produced at Rosebery, Tasmania, to the American Smelting & Refining Company. Last year the production, which amounts to about 12,000 tons per year assaying 55 per cent lead, was sold to Continental smelters.

▶M. R. McKeown, reporting on the

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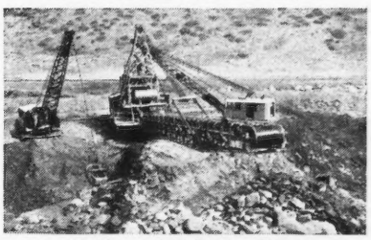
Steel Apron Conveyor handling ore



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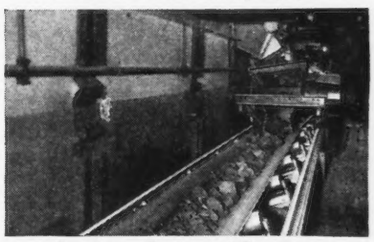
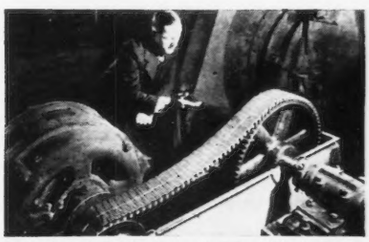
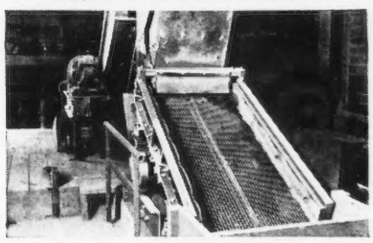


Copper ore Feeder and Conveyor

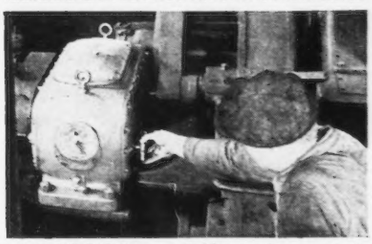


The Link-Belt Silverstreak Silent Chain Drive

Self-Aligning Belt Conveyor Idler



The Link-Belt Vibrating Screen



Link-Belt P.I.V. Gear variable speed transmission

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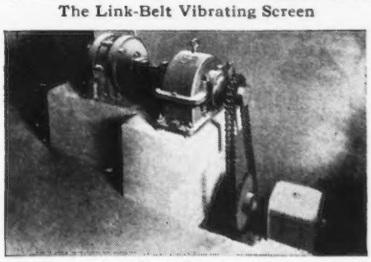
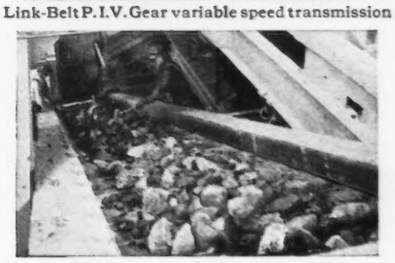


Speed Reducer and Chain Drive operating conveyor



Picking ore on Apron Conveyor

Belt Conveyor type Feeder

▶TASMANIA

property of Zeehan Tin Development, Zeehan, Tasmania, says that three lodes of tin-bearing ore have been encountered. So far, although only a limited amount of prospecting has been done, values in the oxidized zone average 4 per cent tin over a total drive length of 85 ft. Prospects for further favorable development, with possibly somewhat lower values in the unaltered pyritic ore which is encountered at depth, are considered good.

▶ Production at the alluvial tin property of Briseis Consolidated, Derby, Tasmania, which was overwhelmed by flood in August, 1936, was recommenced on a small scale in June, and it is expected that full-scale operations will have commenced in September.

▶ Montana Western Extended, developing a silver lode prospect near Zeehan, Tasmania, reports that the main ore-shoot has been proved so far for 106 ft., with ore in both ends. The lode is averaging about 6 ft. wide and is estimated to assay 20 per cent lead. A prospecting shaft being sunk on the strike of the lode about 80 ft. beyond the end of the North drive from the adit has cut good ore at a depth of 29 ft.

South Africa

New Metal Deposits In Belgian Congo

Development progressing on promising occurrences of lead, copper, and manganese—Mineral output from Uganda increasing

▶ Important discoveries of lead, copper, and manganese have recently been made at South Katanga, in the Belgian Congo. Extensive prospecting work has revealed the presence of large quantities of copper, and further prospecting is expected to prove the full importance of the discovery. The lead deposit has already been worked at surface, from which it is estimated that some 30,000 tons of ore can be won. This year about 10,000 tons will be exported. The first shipment, said to contain 66 per cent lead, has been delivered at Antwerp, Belgium. The manganese discovery is estimated to contain about 850,000 tons of good-quality ore, but its situation involves long transport, and consequently high price and grade ore are necessary for the occurrence to prove economic.

▶ Details of the production of South African chrome and manganese have just been published by the Secretary for Mines, Pretoria. The total production of chrome in the second quarter of this year was 36,444 tons, the average Cr_2O_3 content being 45.13 per cent. Exports were valued at £61,621. The United States, with 22,985 tons, and Germany, with 5,663 tons, were the most important buyers. Production of manganese during the same quarter reached the record total of 160,723 tons, the average Mn content being 43.78 per cent. Holland, Germany, France, and Belgium were the Union's biggest customers.

▶ Uganda's gold and mineral output is steadily advancing. The output for the first seven months of this year shows a striking increase over the record for the corresponding period last year. The following are the relative figures:

	January to July 1936	1935
Tin ore	£59,946	£46,166
Tantalite	4,904	3,033
Gold	74,445	46,611

The gold output of Kenya Colony for July was 4,615 oz., valued at £25,844. During the first seven months of the year the total yield was 34,697 oz. The principal producers were Kakamega and Lolgorien.

▶ The Transvaal produced 987,433 oz. of gold during August, which compares with 996,545 oz. in July.

▶ Some of the lowest grade gold mines of the world are probably found in Southern Rhodesia. Mines which distribute large sums every year in the form of dividends, wages and stores, and transport rates, and which are creating large markets for farming products, are working on ore containing less than two, and in some cases even less than one, pennyweight per ton (20 pennyweights = one ounce). The South Wanderer mine, in the Selukwe district, was able to show profits, milling 170,000 tons of ore last year, and recovering 0.71 dwt., equivalent to 5.07s. a ton. Another striking result is that from the Botha Reef, which, milling 41,000 tons, was satisfied to recover 0.70 dwt. per ton. The Collision mine recovered 1.66 dwt. from 94,400 tons of ore, and the Grand and Louise Grand recovered 1.18 dwt. from 23,000 tons.

Africa

Gold Coast Activity Gains Interest

Producers increasing gold output—Bushtick Mines declares first dividend—Copper production curtailed in Northern Rhodesia

▶ Ashanti Goldfields reports an estimated profit of £80,647 for August after all deductions. Its estimated net earnings for the past eleven months are £928,897. Other West African gold mines are continuing to increase their outputs and earnings, particularly Ariston, Amalgamated Banket Areas, and Marlu. Konongo is also developing particularly well. Gold Coast mining has come to be taken more seriously in London than formerly.

▶ Roan Antelope Copper Mines has declared a final dividend of 2s. 6d. per share, making 4s., or 80 per cent, for the year. It has also declared a share bonus of 200 per cent—that is, two new shares of 5s. each will be given for each share now held. By this operation £3,327,390 of the general reserve is capitalized. Roan Antelope had outgrown its capitalization. Its earnings the past year were equivalent to 36 per cent on the increased capital, being 108 per cent on that then issued. Profit for the June quarter was at the rate of £3,008,000 annually, or 60 per cent on the increased capital.

▶ Northern Rhodesia's copper output was 15,700 long tons in July, against 17,863 tons in June, and 11,086 tons in July last year. Announcement on Oct. 1, by copper producers participating in the foreign control plan, that production would be reduced to 105 per cent of basis quotas, is estimated to mean a reduction in output between 10,000 and 15,000 tons monthly, beginning in December.

▶ The value of the Northern Rhodesian mineral output for the first seven months of the year has increased two-and-a-half fold over the corresponding period of 1936. The total value was £8,065,786, compared with £3,297,053 the previous year. Included in this yield were 103,623 tons of blister copper, valued at £6,244,869; 17,499 tons of electrolytic copper, worth £1,142,805; 1,149,889 lb. of cobalt, valued at £325,575; 3,025 oz. of gold; 268,003 lb. of vanadium; 333 tons of lead; and 1,466 lb. of selenium. Zinc output was 9,970 tons, valued at £250,074. The selenium was received from the refinery slimes of the Nkana copper mine.

Yugoslavia

Trepca Mines Increases Zinc Production

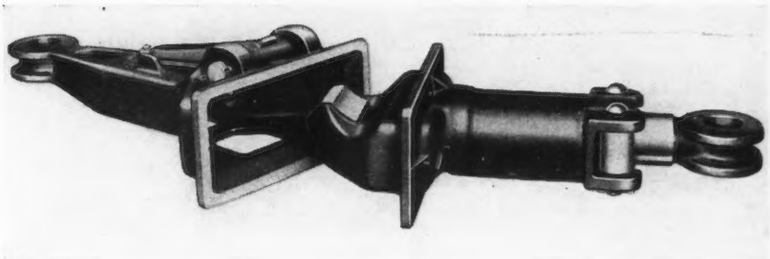
Mining operations at Kopaonik gradually being stepped up to 10,000 tons monthly

▶ Trepca Mines treated 54,703 metric tons of ore in August, a new high record, recovering 5,961 tons of 79.45 per cent lead concentrates averaging 26.1 oz. of silver per ton, and also 6,174 tons of 49.77 per cent zinc concentrates.

▶ At the annual meeting of Kopaonik Mines, Ltd., the British company which began producing lead and zinc ores from its Vojetin mine, in Yugoslavia, in June, A. Chester Beatty, the chairman, said that the completion of the deep adit, 2,710 meters long, in a period of 13½ months was a remarkable achievement, for which great credit was due James Jackson, who had charge of the work. Insufficient stopes had been opened to keep the mill capacity provided by Trepca Mines fully supplied, but at the end of July the output had been raised to over 300 tons daily. Further adjustments in the treatment plant will be required to bring recoveries and the grade of concentrates up to the desired levels. In August, Kopaonik treated 6,879 tons of ore (10,000 tons per month is the objective), producing 723 tons of 76.13 per cent lead concentrates averaging 28.5 oz. of silver per ton, and 855 tons of 46.89 per cent zinc concentrates.

EQUIPMENT NEWS

Automatic Mine Car Couplers



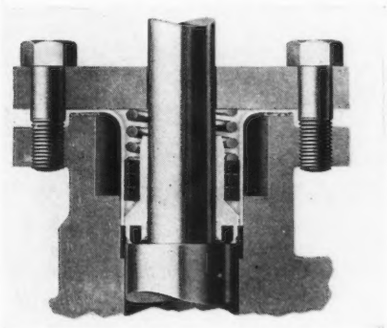
INCREASED SAFETY and efficiency in the handling of mine cars are perhaps the two most important advantages of the new O-B automatic mine-car couplers designed and manufactured by the Ohio Brass Company, Mansfield, Ohio. Made of high-grade cast steel, the coupler bodies are said to be equipped with heavy draft springs which absorb coupling shocks and provide for easy and smooth riding of the trip.

The coupling operation is said to be completely automatic, so that trips may be made up by simply bumping the cars together. It is not necessary for a workman to step or reach between the cars when either coupling or uncoupling. As the coupler heads come together, a spring-actuated cam on the female head engages a recess in the male head. Uncoupling is accomplished by merely raising a lever at the top of the car, which in turn releases the cam.

When conditions require it, the couplers can be set in an unlocked position so as to kick cars from dumps without performing their automatic coupling operation; and the couplers are said to be made so that they will rotate and can, therefore, be used without uncoupling in rotary dumps.

Seal for Rotating Shafts

THE Syntron Company, 510 Lexington Ave., Homer City, Pa., recently perfected and placed on the market a new shaft seal of unique design for eliminating the leakage of gases and liquids around the rotating and oscillating shafts of compressors and pumps. This unit has for its main sealing and wearing surface, an anti-friction and



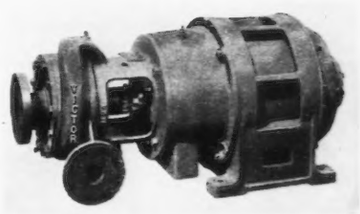
self-lubricating compound insert in bearing metal. The sealing head of bearing metal with its anti-friction insert is held firmly against the shoulder on the rotating shaft to be sealed by strong spring pressure, which also expands the packing rings, sealing the bearing head to the housing. This seal is said to have proved as effective and leak-proof on worn and scored shafts as on new shafts—the soft anti-friction insert quickly seating itself in all inequalities on the surface of the shoulder of the shaft. A distinctive feature of this new seal is the self-centering ring in the sealing head. Quietness of operation by elimination of chattering is said to be assured through the compressed packing rings that grip the seal head up close to the bearing face. The major advantages represented by the manufacturer of this new seal are the entire elimination of leakage over a long period of time without adjustment; self-seating action; self-lubrication; and self-centering. The seal is supplied complete, ready for installation, including the seal nose piece, packing rings, compression spring, seal housing, and gaskets.

Electrode Holder

AN ELECTRODE HOLDER that its manufacturers claim is easy to handle and small enough to be successfully manipulated in tight and cramped places has been recently introduced by the Jackson Electrode Holder Company, 6553 Woodward Ave., Detroit, Mich. The new model, B-4, weighs 15 oz., has a current capacity of 200 amp., is said to handle rods $\frac{1}{16}$ to $\frac{5}{16}$ in., and is made entirely of Mallory 3 Metal. This alloy insures strength and at the same time has 85 per cent of the conductivity of pure copper. The handle insulation is thoroughly ventilated, and the upper tong and compression spring are said to be amply protected by fiber insulation.

Mine Pumps

A NEW LINE OF MINE PUMPS of the two-stage type designed to conserve space and meet a variety of mine-water conditions has recently been developed by the Victor Equipment Company, Kimball-Krogh Pump Division, 844-50 Folsom St., San Francisco, Calif. As illustrated in the accompanying halftones, the new unit can be operated both in a horizontal and a vertical position; in other words, it can be used for general pumping and unwatering



purposes, and where the mine water has a high content of copper sulphate or other corrosive ingredients, the pump body proper, discharge fittings, and canopy top over the motor (when used as sinking unit) are made of 27-14 chrome-nickel steel. High efficiency, saving in floor space, and low maintenance are said to be features made possible by the simple and compact construction. The pumps are available in standard or special materials and in sizes to meet water, capacity, and head requirements.

Light Drifter

INGERSOLL-RAND COMPANY, 11 Broadway, New York, N. Y., has recently introduced a new drifter drill called the DA-30. It is in the 125-lb. class, and is considered especially useful

for many mining operations, such as small drifts, tunnels, and stopes. A new double-opening valve is said to have greatly increased the drilling speed without increasing the air consumption. This new drill has proved to be equally as popular as the DA-35, weighing 156 lb., which was introduced in 1936.

Hose for Dust

TO COMBAT SILICOSIS the United States Rubber Products, Inc., 1790 Broadway, New York, N. Y., has designed new blower and dust suction hoses said to meet practically every known conveying condition. Dust hose, which the manufacturer calls Official P-5508 (for abrasives), is designed for either suction or light pressure, such as that generated by a blower. It will successfully withstand the abrasive action set up in the conveyance of various abrasive types of particles. The carcass of the hose is supported by a steel wire helix and is as light as is consistent with long-wearing qualities. It is finished with outside corrugations to lend flexibility and is available in three thicknesses of pure gum tube. The thickness is dependent upon the abrasive nature of the material being conveyed. Dust-conveying hose is made in sizes of 2, 3, 4, 5, 6, 8, 10, and 12 in.

Prospecting Drill

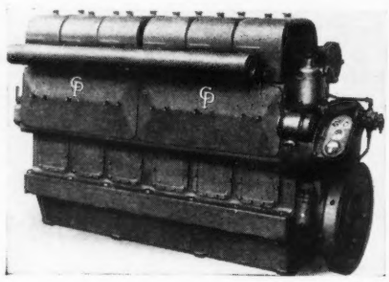
RECENTLY ADDED to the Bucyrus-Armstrong line of prospecting drills is the compact, modern, all-welded, all-steel, light weight, easily transported 23-P placer-prospecting drill made by the Bucyrus-Erie Company, South Milwaukee, Wis.

Built especially for placer test-hole work, the 23-P is said to provide exceptional accuracy in the obtaining of samples of gold and other minerals. Pipe driving and pipe pulling are provided for with a special spudding beam having two positions for the pitman connection. One position gives the machine a rapid down-stroke for effective pipe driving; the other position is said to produce a powerful up-stroke for pipe pulling. Although a comparatively light machine, the new drill swings a heavy string of tools that permits high-speed drilling.

Other features include easy control of all drilling operations, geared hoist and worm feed on the bull reel, all-steel derrick with eight-point pipe bracing, rubber shock-absorber for effective use of steel line, and wheel or truck mounting. Because of these mountings, the 23-P can be quickly moved from one location to another.

Diesel Engine

THE CHICAGO Pneumatic Tool Company, 6 East 44th St., New York City, announces an improved diesel engine said to incorporate the latest developments in construction, design, and combustion control. A feature of this Type 8 engine is that the combustion chamber shape, the location of the

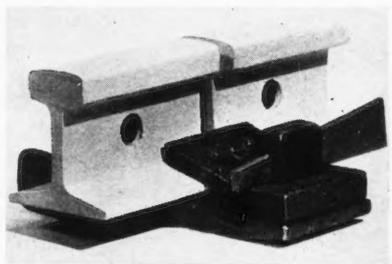


streamlined inlet valve, and the fuel injection system are correlated so as to give combustion efficiency. There are four models from three to eight cylinders and from 90 to 300 hp. The engine-driven fuel transfer pump is also in the gear case, and draws fuel from the storage tank and forces it through a filter to the individual Bosch fuel pumps. Short lines connect the pump to the nozzle. Instant starting is provided by a simple starting valve which admits air to a shaft-driven rotary distributor. This air is said to be carried from the distributor by inclosed piping to all the cylinders. Wearing parts are not exposed to dust and dirt, as the enclosing covers are said to be actually dust-tight, yet easily removed for inspection.

Mine-Track Splicer

RESISTANCE to corrosion and shock, and the smooth surfaces true to pattern, attained in casting, are said to have been responsible for the use of malleable iron in the manufacture of a new rail splicer for mine tracks which is being marketed by the Portable Lamp & Equipment Company, Pittsburgh, Pa. This new splicer is said to eliminate the use of fishplates, bolts, and nuts, and embodies several features which offer definite advantages. Ease and speed of applying is accomplished by reason of its special design.

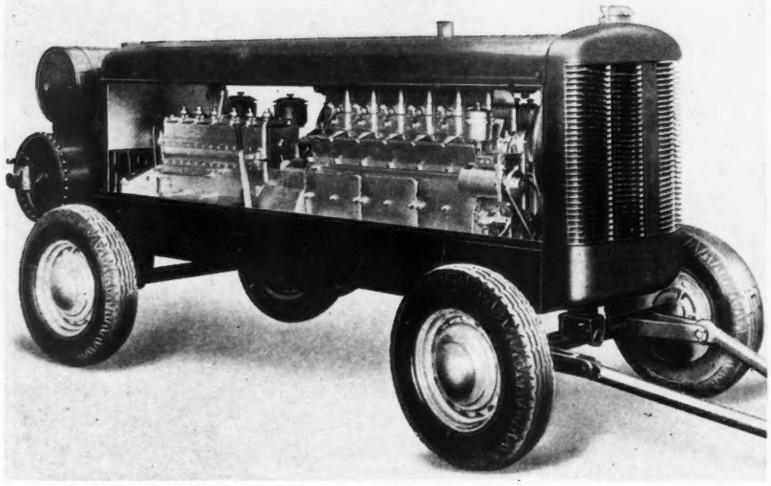
The splicer is made in three parts, the main section, wedge plate and wedge. The main section fits under and flush against the inside of the rails being joined. Two lugs on this part engage



the rail holes, and the plate which is held in place by a wedge locks the splicer against the outside section of rails and against the rail flange, thus bringing the splicer in direct contact with three sides of the joined rail. Dissembly of the splice to joint is said to be accomplished with equal simplicity.

High-Temperature Refractory

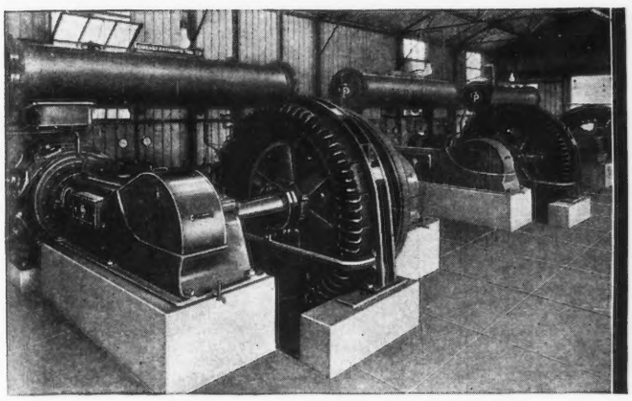
A NEW SERIES of super-refractories, adapted particularly for use in high-temperature furnaces and in contact with corrosive materials has been developed recently at Mellon Institute, Pittsburgh, Pa., according to an announcement made recently by Dr. E. R. Weidlein, director of the Institute. These new refractories, which have been given the trade name "Monofrax," are now available commercially and were evolved through the research of Dr. A. P. Thompson, incumbent of the abrasive Fellowship, in cooperation with the research laboratories of the Carborundum



FAIRBANKS, MORSE & COMPANY, 900 South Wabash Ave., Chicago, Ill., has announced a new self-contained, diesel-powered, 210-c.f.m. air compressor, available with several types of portable and semi-portable mountings, for a wide range of service applications. This new compressor combines the economy and dependability of the F-M Model 36-A diesel with the superior design features of a proved air compressor, making available a compact, light-weight unit said to offer maximum efficiency and absolute reliability under all working conditions.

CP STATIONARY AIR OR GAS COMPRESSORS

Single and two-stage designs; belt, direct-connected motor and steam drive; capacities up to 10,000 c.f.m.; special sizes also available.



This nationally-known contractor's original purchase was two CP Class O Air Compressors. Their performance on punishing contract work dictated the choice of another. All three are here shown working side by side on a large-scale construction job.

the compressors with the "repeat order" reputation . .

No finer expression of confidence in a compressor than a "repeat" order . . . no stronger evidence of a job well done.

Plenty of proof in CP files that "repeat" orders for CP Class O Compressors are the rule rather than the exception . . . and convincing reasons why in Bulletins No. 724 and 725. Send for them!

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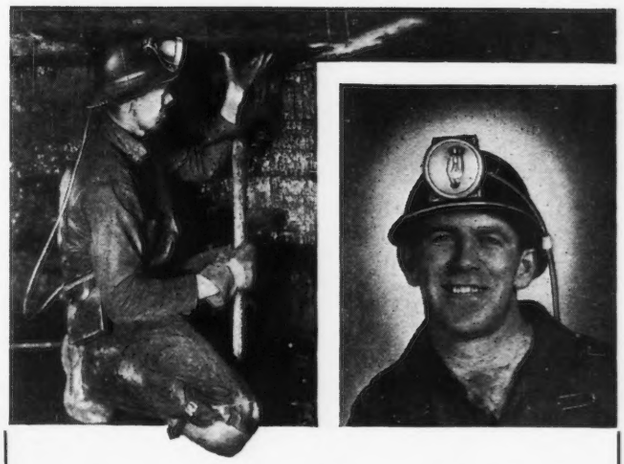

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Electric Cap Lamps

Give MOST LIGHT with LEAST WEIGHT

A crucial test of Cap Lamp efficiency is the amount of light the lamp delivers *in proportion to its weight.*

The WHEAT Model W Cap Lamp weighs 4½ lbs. complete, with battery, cord and headpiece. It delivers over 400 lumen hours* of light in 12 hours.

Therefore it gives nearly 90 lumen hours of light in 12 hours *per pound of weight.*

No Other Cap Lamp Delivers So Much Light in Proportion to Its Weight

Judged by this standard, WHEAT is the *most efficient* of all Cap Lamps.

Moreover, WHEAT delivers 52% MORE light than the next brightest Cap Lamp—is the *only* Cap Lamp whose light STAYS BRIGHT *to the end of the shift.*

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WHEAT

The Lamp for Productivity with Safety

ELECTRIC CAP LAMPS

(Original Approval in 1919, U. S. Bureau of Mines)

Eastern and Midwestern Bituminous Distributors: Portable Lamp & Equipment Co., Pittsburgh, Pa. **Western Bituminous and Metal Fields:** E. D. Bullard Co., San Francisco, Cal. **Eastern Canada:** H. C. Burton & Co., Hamilton, Ontario.

*A lumen hour is the standard measurement of light output

KOEHLER MANUFACTURING COMPANY
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Without obligation on my part, send complete data on the WHEAT Electric Cap Lamp.

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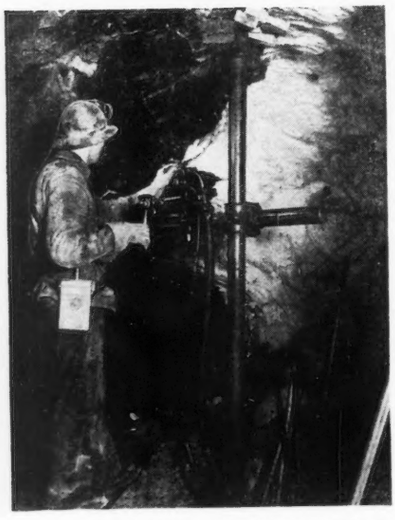
Company. "Monofrax" blocks are cast, by methods similar to those employed in foundry practice, from a melt produced in the electric furnace. Because of the non-metallic nature of their constituents, however, much higher temperatures are required than in casting iron, and the problems involved are therefore much more complex. "Monofrax" refractories are reported to have shown extraordinary resistance to erosive and corrosive attacks at high temperatures. One of the preferred compositions, for example, is said to be six times as resistant to the attack of glass at temperatures of 2700 deg. F. as the best of refractory material hitherto available.

Underground Communication

SUCCESSFUL EXPERIMENTS have been carried out in various industries, using intercommunicating systems of the carrier-frequency type which can be operated without other talking wires than the power-supply lines already installed. In mines this flexibility is considered applicable. Recent tests conducted by American Carrier-Call, 39 West 60th St., New York City, have shown that sets can be operated underground, and communication maintained between deep working levels and the surface, using no other wires than the lighting or power lines already in use in the mine. Special waterproof cabinets are said to have been developed to meet the moisture conditions in such mines, and these can be plugged in anywhere, as working conditions change. In some recent experiments in the oil fields, communication on power lines was carried on at distances up to 100 miles, using carrier-frequency voice currents on the regular power lines of the system.



MINER EMPLOYING ELECTRIC LAMP which has a cord covered with neoprene, the chloroprene rubber manufactured by E. I. du Pont de Nemours & Company, to resist the deteriorating effects of perspiration from miner's body and oils. These lamps are distributed by the Mine Safety Appliances Company, Pittsburgh, Pa.

BULLETINS

Pyrometers. Leeds & Northrup Co., 4930 Stenton Ave., Philadelphia, Pa. A folder describing the manufacturer's various types of pyrometers.

Welding Manual. Hobart Brothers Co., Troy, Ohio. A pocket-size book of nine chapters containing information on general welding practice; also has an index for training operators. P. 94. Price, 50¢.

Catalog. Trumbull Electric Manufacturing Co., Plainville, Conn. No. 101 contains price list and supplement covering type switches, panel boards, magnetic motor control and starter equipment, data on wiring, and schematic diagrams. P. 81.

Chain Drives. Morse Chain Co., Ithaca, N. Y. Bulletin 49 is an engineering data book containing information on specifications and plans for silent chain drives, together with graphs and illustrations. P. 18.

Safety Device. Wheelco Instrument Co., 1933 South Halsted St., Chicago, Ill. Bulletin 1101 describes the Flame-otrol, a gas burner safety device designed to shut off gas in case of flame failure in large heating units. P. 7.

Stripping Shovel. Bucyrus-Erie Co., South Milwaukee, Wis. Folder illustrating the manufacturer's 950-B large stripping shovel. A bulletin has also been issued illustrating the company's bullgrader and bulldozer for T-20 Tractractor. P. 2.

Engineer's Supplies. Lufkin Rule Co., Saginaw, Mich. A small pocket-size booklet containing illustration and prices of tapes and rules for engineers. P. 46.

Refractory Concrete. Quigley Co., 56 West 45th St., New York, N. Y. Bulletin 320 lists qualities of Insulcrete used for direct exposure to flame and furnace gases. P. 3.

Steam Pumps. Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill. Bulletin 6205 describes pumps suitable for a wide range of pumping applications. P. 27. **Turbine Pumps.** Bulletin 6920 describes deep-well turbine pumps with inclosed impellers on oil-lubricated units, and **Bulletin 6920R** covers water-lubricated units. P. 7.

Dragline Scrapers. Sauerman Bros., Inc., 484 South Clinton St., Chicago, Ill., Bulletin 148 describes dragline scrapers and slackline cableway excavators for use with tractors. P. 3. **Catalog No. 18** is a well-illustrated data book on the manufacturer's products. P. 84.

Laboratory Equipment. General Engineering Co., Inc., 159 Pierpont St., Salt Lake City, Utah. Bulletin No. 701 describes and illustrates the diverse laboratory equipment developed by the company. Part of the booklet discusses the laboratory and ore-testing facilities maintained at Salt Lake City, Utah. P. 23.

Mechanical Loaders. Eimco Corporation, 634-666 South Fourth West St., Salt Lake City, Utah., Illustrated folder describing the company's new Eimco-Findlay Model 12 loader. P. 4. **Filters.** Bulletin 401 discusses the characteristics, construction, and function of the different types of continuous vacuum filter equipment manufactured by the company. Numerous illustrations and capacity tables are included. P. 22.

Bearings. Fast Bearing Co., Baltimore, Md. Bulletin describing the manufacturer's types of precision bearings. Is well illustrated and contains table of standard dimensions of bearing numbers. P. 15.

Hydraulic Gravel Elevators. Joshua Hendy Iron Works, 206 Sansome St., San Francisco, Calif. Bulletin 205 lists the specifications, applications, and features of the company's gravel-elevating equipment. It is well illustrated and contains data valuable to the hydraulic mine operator. P. 4.

Mine Cars. Joshua Hendy Iron Works, 206 Sansome St., San Francisco, Calif. Bulletin 206 illustrates in an attractive manner the new mine car developed and placed on the market recently by the company. P. 4.

Welding Piping Design Handbook. Linde Air Products Co., 205 East 42d St., New York, N. Y. A 6x9-in. book containing numerous figures illustrating layout and design of various types of piping for welded connections. Among subjects discussed are welding, metallurgy, fabrication and erection considerations, and welding speed. The book has five parts and an appendix, a glossary of terms and a bibliography. P. 200.

Mine Pumps. Worthington Pump & Machinery Corp., Harrison, N. J. Bulletin WP-1092 contains data and illustrations of pumps for general mine service. P. 6. Bulletin L-711-B-2 describes horizontal dry vacuum pumps. P. 8.

Screens. Robins Conveying Belt Co., 15 Park Row, New York, N. Y. Bulletin 99-A describes and illustrates the manufacturer's Eliptex screens; tables of dimensions of single to triple deck screens are given on p. 8.

Air Filters. Northern Blower Co., West 65th St., Cleveland, Ohio. Bulletin 500-2 illustrates and describes the "Norblo" Round type air filter. P. 4.

Torson Balances. American Askania Corp., M. & M. Building, Houston, Tex. Pamphlet Gco 120E describes torsion balances for use in geophysical prospecting, and the book contains an interesting bibliography. P. 32.

Magnetic Field Balances. Pamphlet Gco 120E describes manufacturer's equipment used in applied geophysics in petroleum and mining geology. P. 16.

Flexible Coupling. Falk Corporation, Milwaukee, Wis. Bulletin 4100 describes the new FA series of the manufacturer's Steelflex coupling, covering design, rating, method of selection, and dimensions. P. 35.

Pumping. Caterpillar Tractor Co., Peoria, Ill. Bulletin 4148 describes performance of the manufacturer's diesel engines used for pumping mines, dredges, sand pumps, and other uses. P. 1.

Insulating Brick. Johns-Manville, 22 East 40th St., New York, N. Y. Folder illustrates application of new JM-20 insulating brick. P. 3.

Mining Equipment. Morse Bros. Machinery Co., 2900 Broadway, Denver, Colo. General catalog of reconditioned mining and milling machinery. P. 16.

Recording Meters. Brown Instrument Co., Philadelphia, Pa. Catalog 3005 describes the manufacturer's meters recording CO_2 and combined CO_2 and flue-gas temperature recorders. P. 24.

INDUSTRIAL NOTES

During the week of Feb. 14-19, 1938, a "Canadian Mining Exposition" will be held in the Grand Central Palace, New York. The exposition will afford an opportunity to those companies which service mines in Canada to exhibit their equipment. It will be under the direction of Matallurgical Exhibits, Inc., 444 Madison Ave., New York, and The Canadian Mining and Metallurgical Bulletin, 811 Drummond Building, Montreal, Canada. During the same week the American Institute of Mining and Metallurgical Engineers will hold its annual convention in New York City, and the Honorable T. A. Crerar, Dominion Minister of Mines and Resources, has tentatively accepted to speak as a representative of Canada at the A.I.M.E. dinner, on Feb. 15.

The 1937 Metal Congress and Exposition will be held Oct. 18 through 22d, in the Atlantic City Auditorium, at Atlantic City, N. J.

Chicago Pneumatic Tool Company announces the opening of a direct factory sales and service branch at 119 West Second South, Salt Lake City, Utah. Otto A. Ray has been appointed manager.

Ralph L. Wilson, formerly metallurgical engineer of the Timken Steel & Tube division of the Timken Roller Bearing Company, has become associated with the Climax Molybdenum Company, in the capacity of metallurgical engineer, in its development field.

Dust Hazards and Their Control in Mining

Distinctions to Be Observed in the Adoption of Methods Of Procedure in Both Metal and Non-Metal Mining Operations

ADVOCATES of health and safety in mining have found themselves confronted in recent years with what might appear to be contradictory procedures with regard to dust occurrence in mines and what seem to be suitable methods or measures to give the mines and mine workers a maximum measure of protection against dust. A concerted and relatively effective drive has been made to introduce rock dust into bituminous and lignitic coal mines to prevent or limit explosion and fire disasters and an equally determined effort has been and is now being made to curb rock dust or to eliminate it from air in metal mines to prevent or at least limit the occurrence of miners' consumption and other diseases. Both procedures are logical, even though the efforts appear to be of an opposing nature.

Deadly Metal-Mine Dusts

Though rock dusting has not been applied in coal mines nearly as universally or as effectively as could and should be done, nevertheless a careful analysis of the record of the past ten years indicates that the amount of rock dusting that has been done has resulted in the saving of a minimum of 200 lives annually—certainly no small achievement. Largely but by no means wholly due to the use of rock dusting, the number of fatalities from explosions and fires in our coal mines in the last four years has been reduced more than 75 per cent compared with the four-year period 1911-15, the first years of the existence of the United States Bureau of Mines, which was brought into existence in 1910 largely to try to *do something* about reducing the disgracefully high fatality occurrence from explosion disasters in our coal mines. Hence, rock dusting has been given at least a trial and has proved its effectiveness definitely.

The campaign to eliminate or at least to reduce the presence of rock dust in the air of metal mines has been by no means as sensational or as definitely successful as has that to introduce rock dust into bituminous and lignitic coal mines; this is due to the difference in the spectacular feature of the results of failure to apply the remedy in taking proper precautions as to air-borne dust in metal mines, as compared with failure in controlling coal-mine dust; failure in controlling dust in certain kinds of coal mines may cause scores of human beings to be hurled into eternity in a few seconds, whereas failure to handle metal-mines dust conditions adequately, works its harm on single individuals and usually only after months or years of exposure. Notwithstanding this lack of spectacular action of air-borne rock dust, there is good reason to believe that since the beginning of the present century more underground workers in the United States have gone to their graves through the breathing of harmful dusts than have been sent there through the more sudden and spectacular instrumentality of explosions or fires.

Silica Most Harmful of Dusts

It now seems probable that the most harmful of the ordinary dusts to breathe is that of silica, but it must be emphasized that not even free silica (supposedly the most detrimental of the silica dust) is harmful unless it is breathed in considerable *quantities or concentrations* and over extended periods of time; no human being ever lived any considerable span of years on this earth of ours without breathing silica dust (a large part being free silica), yet this does not mean that all of the people in the world now have or have had silicosis. In other words, the *quantity* of dust taken into the respiratory organs is a controlling factor in dust-respiratory harmfulness, and common sense indicates that the quantity of dust breathed is one of the dominant factors as to possible harmfulness to health from any kind of air-borne dust. What constitutes that quantity limit, no human being knows at this time, notwithstanding the fact that numerous so-called "threshold" limits are now being announced, some of them being embodied in state regulations or laws. Predicating dust-respiratory harmfulness on a sliding scale in proportion to the free-silica content of the dust is anything but logical; in the first place, no one knows whether a dust of 1 per cent silica is or is not more harmful than a dust of 2 per cent, 3 per cent, or even 30 per cent. Moreover, air with a certain number of dust particles per cubic foot with a silica content of 1 per cent (or any other percentage) would probably be far more harmful to one person than to another or would be far more harmful to a person working at maximum capacity (as when on a contract basis) than to one on a day-pay basis, or more harmful to a person working in an atmosphere of 85 or 90 deg. F. with relative humidity 90 or 95 per cent than to one working in an atmosphere of 60 deg. F. with relative humidity around 60 per cent. Numerous other more or less similar contributing factors make unworkable or futile the establishment of regulations as to the allowable number of dust particles on a sliding scale in proportion to silica content of the dust. In some industries, such as metal mining and tunneling, there may be as many different percentages of silica in the mine air as there are places working, and in many metal mines it is entirely unlikely that the percentage of silica in the air of a working place today will be at all like the percentage of silica in that same place tomorrow; to apply to most metal mines the sliding scale of allowable number of dust particles in the air in proportion to silica content would be utterly impossible of enforcement or fulfillment.

"Standard" Criteria Indefinite

At present there is definite lack of knowledge as to the size of air-borne dust likely to be harmful, and present-day so-called "standards of air dustiness" are built on numerous uncertain premises on this point alone. Different authorities find varying maximum and minimum sizes of dust in lungs of

deceased silicotics ranging from as small as 0.2 micron to as large as 10 microns, and from this fact it is deduced that, so far as lung harm is concerned, the dust to be avoided is that from 2/10 to 5/10 micron, on the low side, to 6 or even as high as 10 microns, on the high side; this leaves much leeway, because an air-dust sample containing 10,000,000 particles (5/10 to 6 micron size) per cubic foot of air might easily have 30,000,000 particles 2/10 to 10 microns in size. Moreover, if the solution theory of dust harmfulness to the lungs is correct, there is the best of reasons to think that particles much smaller than 2/10 micron are likely to be definitely dangerous.

Floating Dust Harmful

To hold that the only harmful dust sizes are those found in the lungs is anything but good reasoning, because it is a certainty that dusts from 10 microns to 100 or more microns in size when floating in the air are drawn into the nostrils and other protective air passages, and if in large numbers soon clog these protective agencies and passages, giving practically free unobstructed entrance of the so-called "harmful" dusts (say 2/10 to 10 micron sizes) into the lungs to perform maximum injury. It does not seem to be logical to disregard these larger sizes entirely, as is now almost universally done in the so-called "dust standards" being considered and announced. Again, the presentday instruments and methods of sampling air-borne dust and making the determinations as to number of particles present are anything but accurate or definite, even when handled by technically trained experts; and methods or instruments applied to certain industrial conditions are wholly unsuited to others. A condition as to air dustiness found in one sample in a certain place is unlikely to be anything like another sample taken immediately afterwards in the same place and in the same manner; this is true where the sampling is done instantaneously by a grab method or over a period of several minutes. In other words, the technic as to quantity particle determinations in air dustiness is by no means definite, accurate, fair, or dependable, not only as to conditions as between different plants but even as between different time periods in the same place in any one plant.

With all of these variables as well as numerous other uncertainties as to air-borne dust, it seems to be a travesty on justice to try to embody in laws, and regulations having the force of law, rigid standards as to air dustiness; if quantity standards as to air-borne dust are made, they should certainly be labeled tentative; and the technic of taking the air samples and making the particle determinations should be carefully outlined and enforced; otherwise, much injustice can be inflicted through inexperience or the malice of the persons making the determinations.

The remedy for harm to health from dust in mines of today is chiefly twofold—use of water to "kill" the dust and use of ventilating current of fresh air to remove or dilute air dustiness where it is not feasible to "kill" the dust by water. In metal mines, no drilling of any kind should be allowed without simultaneous use of water, and the water should be under pressure and forced through the drill steel so as to "kill" the dust as it is being formed at the face of the drill hole. Many mines resist this practice because of expense of wet-drilling equipment and of placing and maintaining water lines and water at all working faces; miners resist because they hate to do anything they have not been accustomed to doing, because the use of water entails new responsibilities, and because the water tends to wet the clothing. Many other reasons are given by owners as well as by miners why wet drilling cannot be done, but in at least nine out of ten mines wet drilling can and should be insisted upon.

Blasting Creates Dust Menace

Blasting should be done after the working shift instead of during the shift, as it has been found that next to dry drilling blasting is the worst present-day producer of dust in air in sizes and concentrations likely to be harmful to those who breathe it. Moreover, there is good reason to suspect that the gases produced in blasting have a rather serious harmful effect on those who breathe fine dusts, due to inflammation of the respiratory organs by the breathing of those gases even in relatively minute proportions. Various available adjuncts to blasting, such as water blasts or curtains, and mist projectors, as well as frequent wetting of the muck piles after blasting and of the face region before blasting, are now required and utilized by careful mine operators, even when blasting is done at the end of the shift or on the off shift.

This article treats only lightly of dust hazards and has been confined chiefly to dust explosibility and to respiratory disease and almost wholly to lung affections; it gives little or no consideration to the numerous ill effects on human organs other than the lungs due to breathing more or less insoluble dust, or the harm to other internal organs (stomach, liver, kidneys, lungs, heart), or to the nose, throat, and bronchial tubes from breathing more or less soluble or so-called "poisonous" dusts; nor does it take into consideration the numerous hazards to human beings in the breathing of organic dusts, with accompanying hay fever and kindred ills. Moreover, numerous dusts, both organic and inorganic, have harmful influences of various kinds on eyes, ears, and other parts of the body, and on the skin from external contact; and some dusts cause harm to health by being absorbed through the skin. Hence, though pulmonary disease due to the breathing of air-borne dust is unquestionably of great present-day importance, its various ramifications (pneumoconiosis, silicosis, anthracosis, or these combined with tuberculosis), though vitally important, constitute by no means its only detrimental effect.

All Dust Is a Menace

A close analysis of the status of dust in industry (and in general life outside of industry also) indicates that numerous (one might almost say innumerable) uncertainties still exist as to specific features connected with dust harmfulness, and so numerous and far reaching are these uncertainties (only a few of which have been indicated in this paper) that almost the only definite fact now available is that dust is a menace and all kinds of dust likely to come in contact with human beings should be reduced to a minimum or at least be held under positive control until such time as much well-planned, well-correlated research and investigative work (field and laboratory) has been done on almost every phase of the subject.

Numerous clear-thinking persons who have made a minute, comparatively long-time study of dust harmfulness are now expressing the view that much remains unknown as to the health harm from dust, and that about the only safe procedure is to take all reasonable measures to reduce air dustiness in places where men must work or live.

Wise mine-operating officials of the present and of the future will be far less inclined to split hairs as to what constitutes a harmful dust and concentrate their faculties and abilities on the feasible methods of handling the dust hazard so it will be reduced to a minimum in the property and as applied to the employees. At present, the best procedure is to kill the dust, and it can be done!

Excerpted from I. C. 6954, United States Bureau of Mines, from paper by D. Harrington, Chief, Health and Safety Branch, United States Bureau of Mines, Washington, D. C.